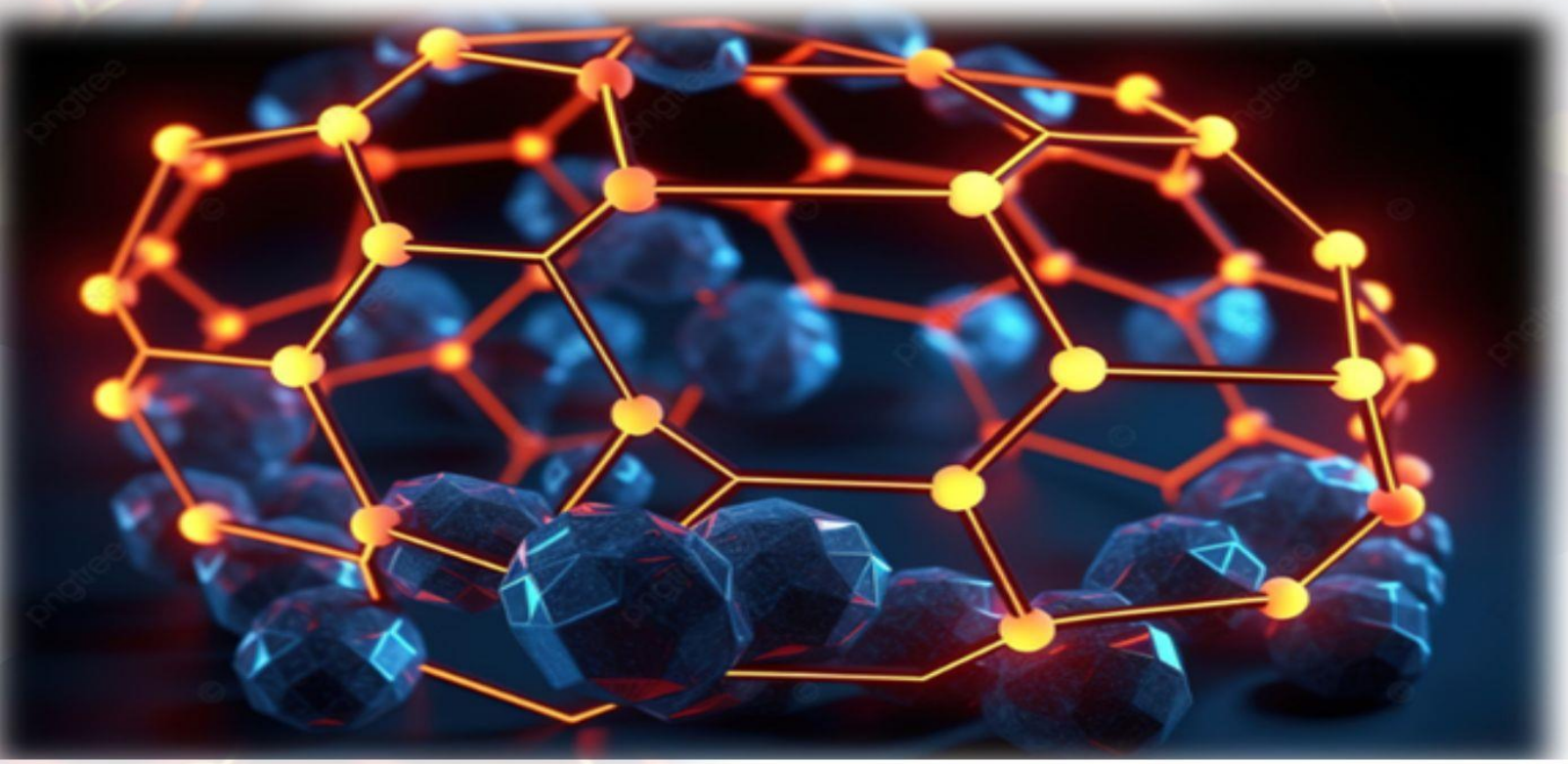
Proceedings of

National Conference on New Horizons in Nano-scale Materials & Their Applications

15thMarch-2024



National Conference

Published by

Department of Physics

M.S.P. Mandal`s

Arts, Commerce and Science College, Kille-Dharur

ISBN Number: 978-93-340-3434-9

Proceedings of National Conference on New Horizons in Nano-scale Materials & Their Applications

15th March-2024

Organized by

Department of Physics

M.S.P. Mandal`s

Arts, Commerce and Science College,
Kille-Dharur, Dist. Beed, MS, INDIA

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ISBN Number: 978-93-340-3434-9 ***Publication Date: 15/03/2024***

Disclaimer

In the Abstract Book of ***"New Horizons in Nano-scale Materials & Their Applications" (NHNMA-2024),*** *scheduled for March 15th, 2024, organized by the Departments of Physics at Arts, Commerce & Science College in Kille-Dharur, Maharashtra 431124 India. The authors hold responsibility for the originality, style, and content. The Organizing Secretary, Convener, Co-Ordinator, and Organizing Committee are not required to endorse the viewpoints expressed in the abstracts. All abstracts featured in the Book are directly submitted by the authors via email and are included in their original form.*

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K. M. Jadhav

Emeritus Professor (Physics) Incharge, School of Basic and Applied Sciences, MGM University, Chhatrapati Sambhajinagar.

Resource Person

Raghumani Singh Ningthoujam

(Scientist, Chemistry Division, Bhabha Atomic Research Centre, Mumbai 400085, India)

Topic: The Nobel Prize in Chemistry 2023: Discovery and Synthesis of Quantum Dots

Prasad P. Phadnis

(Chemistry Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400085, India)

Topic: Development of Nano formulations for Theragnostic Utility in Cancer Therapeutics

Prof. Rajendra R. Deshmukh

(Institute of Chemical Technology, Matunga, Mumbai 400 019)

Topic: Pulsed plasma polymerization to control film chemistry for various applications

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SCOPE AND OBJECTIVES OF CONFERENCE

Knowledge Exchange: The NHNMA-2023-2024 serves as a platform for participants to exchange knowledge, ideas, and experiences related to nanotechnology research, development, and applications. This includes sharing insights into cutting-edge research findings, innovative technologies, and emerging trends.

Research Presentations: Researchers and scientists present their latest findings, breakthroughs, and advancements in various areas of nanotechnology, including nanomaterials, nanoelectronics, nanomedicine, nano photonics, nanomanufacturing, and more. This helps disseminate new knowledge and foster collaboration among peers.

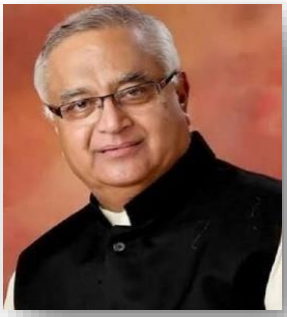
Networking Opportunities: The conference provides ample networking opportunities for participants to connect with fellow professionals, potential collaborators, industry partners, funding agencies, and experts in the field. Networking sessions, social events, and poster presentations facilitate interactions and collaborations.

Policy Discussions: Policymakers, regulatory authorities, and governmental representatives participate in discussions to address regulatory, ethical, safety, and societal implications of nanotechnology. These discussions help shape policies, regulations, and guidelines governing the responsible development and deployment of nanotechnologies.

Education and Outreach: The conference may include sessions focused on educational initiatives, outreach programs, and public engagement efforts aimed at raising awareness about nanotechnology and its potential impact on society. Workshops, tutorials, and outreach activities target students, educators, and the general public.

Future Directions and Challenges: Panel discussions, keynote speeches, and thematic sessions explore future directions, challenges, and opportunities in nanotechnology research and innovation. Participants discuss strategies for overcoming technical barriers, addressing ethical concerns, promoting interdisciplinary collaboration, and achieving sustainable development goals.

Publication and Dissemination: Proceedings of the conference will be published in journals, special issues, ensuring that the research presented reaches a wider audience and contributes to the scientific literature in the field of nanotechnology.



MESSAGE

Marathwada Shikshan Prasarak Mandal's Arts, Commerce and Science College Kille-Dharur, specifically the Department of Physics, is hosting a one-day National Conference on ***New Horizons in Nano-scale Materials & Their Applications (NHNMA-2024) on March 15th, 2024***. We're also publishing a special souvenir for this event and a special issue of journal.

This college is known for providing excellent education and preparing students for academics mainly in the rural area of Beed district. It's a great honor that the college has received an A grade with a CGPA of 3.08 from NAAC, Bangalore, during its fourth reaccreditation cycle.

The main goal of this conference is to bring together experts to discuss topics related to nano-scale materials and their applications. We hope this will benefit researchers and academics worldwide and lead to new opportunities in this field. I wish everyone involved in this conference the best of luck, and I'm excited about the positive outcomes this academic journey will bring.

Hon. Prakash Solanke
President,
M.S.P. Mandal, Chh. Sambhajinagar

MESSAGE

I am delighted to announce that Marathwada Shikshan Prasarak Mandal's Arts, Commerce Science College in Kille-Dharur, specifically the Department of Physics, is organizing a One-day National Conference on ***New Horizons in Nano-scale Materials & Their Applications (NHNMA-2024) on March 15, 2024***. Additionally, a souvenir will be published for this event and a special issue of journal.

This College is well-known for providing excellent higher education in terms of quality and quantity. It has achieved an A grade with a CGPA of 3.08 in the NAAC 4th cycle reaccreditation.

The conference aims to inspire and engage young minds to excel in various areas of Physical Science by providing a platform for academicians and researchers from different sub-disciplines of the theme. This conference will raise awareness among budding researchers, especially in the local region, about the current scenario in Physical Science.

I congratulate the organizers for creating such an academic platform for delegates nationwide to share new ideas. This collaboration of research outcomes will undoubtedly contribute to advancements in Science and Technology.

I wish this conference great success!

Hon. Satish Chavan
Secretary
M.S.P. Mandal, Chh. Sambhajinagar

MESSAGE

I am pleased to announce that Marathwada Shikshan Prasarak Mandal's Arts, Commerce Science College Kille-Dharur, Department of Physics, is organizing a One-day National Conference on ***New Horizons in Nano-scale Materials & Their Applications (NHNMA-2024)*** *on March 15, 2024.* A souvenir will also be published for this event.

Our college is widely known as one of the top learning centers in Maharashtra and particularly in the Marathwada region. It has been graded A with a CGPA of 3.08 by NAAC, Bangalore, in the 4th cycle of reaccreditation, and offers state-of-the-art facilities to students and staff.

The purpose of this conference is to encourage scholarly discussions and deliberations on the theme, which will lead to significant outcomes in academic and research fields. The abstract book from this conference will provide innovative ideas for advancements in related areas.

Best of luck to everyone involved!

Hon. Shri. Jaysing Dhairyashilrao Solanke
Member CDC
ACS College, Kille- Dharur

MESSAGE

Marathwada Shikshan Prasarak Mandal's Arts, Commerce, and Science College Kille-Dharur has been dedicated to providing quality education to the community while addressing social responsibilities, student development, progress, and research. Research is a key focus for the faculties in campus, with all science departments actively engaged in impactful research alongside effective teaching and learning processes. The college is proactive in student-centered activities and initiatives.

The goal of our upcoming conference is to bring together a diverse group of scientists from across the nation to share breakthrough ideas and recent developments in physical science. I extend a warm welcome to all participants and wish everyone the best for the conference.

Prof. Dr. G. K. Kakade
Principal
ACS College, Kille-Dharur

ACKNOWLEDGMENT

As the Convener of the National Conference on New Horizons in Nano-scale Materials & Their Applications (NHNMA-2024) held on March 15, 2024, I am delighted to share that the conference was a great success. We had active participation from various institutions, and the renowned resource persons and scholars delivered excellent presentations and engaged in fruitful discussions.

I want to acknowledge the generous assistance we received from various sources, without which this successful event would not have been possible. Lastly, I extend my thanks to our Management and all staff members who contributed actively to making this event a success.

Dr. L. B. Jadhavar
Convener & Head, Department of Physics
ACS College, Dharur

INDEX

Nanotechnology: A Tool to Overcome Pollution and Energy Crises

K. M. Jadhav
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ABSTRACT

In current situation of world, both developed and under-developed countries encountered some mutual problem, such as pollution (Water and Air) and energy crises due to climate change and over population. Day by day with the increase of population demand of energy consumption increased but world have limited natural energy resources. Water is a precious resource and without it life is not possible on earth.

Water is getting polluted day by day due to excessive and careless use so the percent of available drinking water is reducing. Nanotechnology provided us ground-breaking results in every field of research. In energy sector, photocatalytic technique provided using oxide nanomaterials us environmentally friendly, long-life hydrogen (H_2) production solution and in pollution this technique provided us environmentally friendly and with no side effect solution of water treatment and air treatment. Nanomaterials exhibits very interesting properties such as high stability, large-surface to volume ratio, activity, availability, low cost, nontoxicity, moderate band gap etc. Oxide nanomaterials plays vital role in energy (hydrogen production) as well as in water pollution (Dye degradation) because of their very good photocatalytic activity. Ferrite nanoparticles on account of their semiconducting behavior are effectively used as a photocatalyst. In the present talk, attempt is made to explain the utility of nickel ferrite nanoparticles as a tool to overcome energy (H_2 production) and pollution (Dye degradation) crises.

The Nobel Prize in Chemistry 2023: Discovery and Synthesis of Quantum Dots

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ABSTRACT

Quantum dots (QDs) are the semiconducting materials. Their particle sizes are in nanorange, which is less than the exciton Bohr's radius. When a sufficient photon of light is absolved by quantum dots, it can generate excitons. Depending on the particle size, absorption peak position varies. In general, absorption peak position shifts to the shorter wavelength with decrease of particle size. Absorption co-efficient of QDs is much higher than that of bulk (micron size) particles. These QDs have been prepared through bottom-up and top-down approaches for the last 40 years. Their potential has been realized in the various applications such as sensor, LEDs, catalysis, and bio-imaging, etc.

In 1981, Alexei I. Ekimov (Vavilov State Optical Institute, USSR) prepared the different sizes of CuCl nanoparticles in glass system in USSR.Glass was found to be the different colours depending on size of particles and it was published in a Soviet Scientific Journal [1]. This was happening during his Ph. D. period [1]. In the same time, Louis E. Brus (Bell Laboratories in the US) was unaware of Alexei I. Ekimov's work and observed size-dependent quantum effects in particles (CdS) floating freely in a solution [2]. His theoretical model on quantum size effects on absorption peaks was establishedand confirmed experimentally by many scientists today. In 1988, Moungi G. Bawendi started his postdoctoral training at Louis E. Brus' laboratory, where he learned the preparation of QDs, but there was a need to improve the methods to prepare monodispersed at that time. After joining at MIT university as research leader, his group prepared the monodispersed and controlled sized nanoparticles of CdSe through hot-injection method [3]. Thesignificant contributions to humanity using QDs were recognized by the Nobel Committee for Chemistry. Moungi G. Bawendi, Louis E. Brus and Alexei I. Ekimov was awarded the Nobel Prize in Chemistry 2023 for the discovery and development of quantum dots.

We also contributed the preparation of magic sized clusters, bare mono-dispersed QDs and its usefulness in light harvesting [4]. For nanoparticles with small sized Bohr's radius, it is difficult to generate the quantum confinement. However, generation of the exciton/quantum confinement is possible in two semiconductors and semiconductor-insulator interface. So, this approach was initiated in BARC, Mumbai during 2007-2010and can improve energy transfer process [5-8].

Development of Nanoformulations for Theragnostic Utility in Cancer Therapeutics

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ABSTRACT

Cancer is a fatal disease and a 2nd leading cause of deaths across the globe. Its early diagnosis gives better chances to save life. Even though, diverse drugs are being clinically used, they have severe side effects due to their non-specific interactions which can be avoided by targeted drug delivery by treatment using their formulations. Since 2005 large number of nano formulations were evaluated. Further, the formulations with ability of simultaneous diagnosis, therapy and with multiple modes of treatment known as multimodal theragnostic formulations which are anticipated to enhance efficiency of treatment were also explored. Hence, we have developed the silica coated persistent luminescent (ZnGa2O4), up-conversion (NaYF4@NaErF4) or magnetic (Fe3O4) based nanoformulations conjugated with 2-D-Glucose, 2-Deoxy-D-Glucose (2-DG), citrate, polymers or 5-aminolevulinic acid and 10B(OH)3 etc. These nanoformulations exhibited biocompatibility and stability at physiological conditions. The persistent luminescent ZnGa2O4 based formulations conjugated with 10B(OH)3 and conjugated with tumor targeting peptides (pHLIP) have exhibited their anticancer utility by boron neutron capture therapy (BNCT) along with *in-vitro* bio-imaging by photon-imager in animal models to track progress of treatment. Another formulation based on photosensitizer drug 5-aminolevulinic acid conjugated on NaYF4@NaErF4 has exhibited excellent anticancer activity by photodynamic therapy (PDT) by 980 nm irradiation on tumors induced in mice. Along with these, the affinity of glucose for cancerous cells was utilized to identify the cancer cells and the demarcation of tumor with the help of NaYF4 based nanoformulations coated with 2-DG. They have potential to be used in precision surgery. The Fe3O4 based formulations were utilized for the drug delivery of Pt(IV) prodrug of cisplatin to avoid the severe side effects along with hyperthermia to kill cancer cells *in-vitro*. In conclusion, we have developed, the strategies for early stage detection of cancers and treatment with diverse modalities. These formulations have a potential for their further pharmacological evaluations.

Pulsed plasma polymerization to control film chemistry for various applications

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ABSTRACT

Pulsed plasma polymerization offers an efficient way to control film chemistry at a very low average power. Variable duty cycle pulsed plasma polymerization of various monomers was employed to synthesize polymeric films of different film chemistry. Functional groups such as hydroxyl, carboxylic, amine, bromine, fluorine containing groups etc. were incorporated onto the polymeric substrates as well as nanoparticles using different precursor monomers for various applications. These groups are very important from application point of view to attach bio-molecules for a variety of applications. We also report the controlled release of drug as a function of variable duty cycle. Similarly, we demonstrate that gaseous plasma can also be used to increase solubility and intrinsic dissolution rate thereby enhancing bioavailability of a hydrophobic drug. The extent of plasma surface modification is characterized by XPS, FTIR, Profilometer and contact angle measurement.

Effect of Fe doping on Structural and Optical properties of ZnS nanocrystals

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ABSTRACT

Zinc sulphide (ZnS) is group II-VI wide band gap semiconductors [1]. With the emergence of nanoscience, nanostructured ZnS has got a lot of importance in recent years. Due to fast development of nanoscience and nanotechnology, ZnS nanocrystals are now able to be synthesized in variety of morphologies such as nanoparticles [2, 3], nanowires [4,5], nanorods [6,7], nanobelts [8], nanosheets [9], which exhibit various physio-chemical properties and they are highly sensitive to size, shape and synthesing environments. In this work, we report the structural and optical properties of undoped ZnS nanoparticles and 2% Fe doped ZnS nanocrystals. Undoped and 2% Fe doped ZnS nanocrystals are chemically synthesized and investigated by X-ray diffractometer, UV-Visible spectrophotometer and spectrofluorometer. The crystallite sizes of the undoped and Fe doped nanocrystals are found to be 2.2 nm and 3.07 nm, respectively. The band gaps are 3.64 eV and 3.45 eV for the undoped and Fe doped ZnS nanocrystals, respectively. The photoluminescence properties are significantly different for the undoped and Fe doped nanocrystals. The emissions for both the un-doped and Fe doped ZnS nanostructures are found to be at nearly the same positions, however intensities of all the emissions are found to decrease significantly after doping. In summary, the presented work shows Fe doped ZnS, causes significant structural and band gap change, and quenching of the luminescence behaviour of ZnS nanocrystals.

Group Velocity Dispersion in Congruent Lithium Niobate Crystal

Vijay Huse[1]

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ABSTRACT

The effect of material dispersion on the propagation of the pulses of light is governed by the refractive index n and its higher derivative. The group velocity plays an important role in the group velocity dispersion (GVD) and responsible for the pulse broadening. In this paper, Icalculate the GVD using the Sellmeier equation. The calculation of GVD coefficient for the Congruent Lithium Niobate (CLN)done and the zero-dispersion wavelength can vary in the range of 1.82-1.83 μm for both frequency dependent and the wavelength dependent GVD coefficients.

Keywords: Dispersion, Group Velocity, Sellmeier Equation

Multiphase ISM in IRAS and MIPS Detected Lenticular Galaxy NGC2787

B. T. Tate[1]

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ABSTRACT

It is a Lenticular galaxy (SB0) lacated in Ursa major constellation with blue band mag-nitude 11.82. It hosts a spectacular tilted nuclear dust ring of radius ∼1.5 - 10 arcsec , an inner disc and a bulge with disc-like kinetic property. The presence of dust in this galaxy was already implied by its detection at 60 and 100μm by IRAS. It is found that Optical dust mass is lower than that estmated using IRAS dust mass and also using MIPS data. The galaxy is highly inclined to the line of sight because of the large flattening of the disk and the partial ring enhancement at the two ends of the bar. X-ray Luminosity of diffuse gas in D_{25} region in this galaxy is found to be 1.26×10^{39} ergs/sec with a contribution of 49%, while that of the point sources 1.33×10^{39} ergs/sec and makes 51% of the total X-ray luminosity of this system. We have detected 12 discrete sources within D_{25} region, whose cumulative spectrum was well constrained by a power lawcomponent with photon index 1.44± 0.09. Temperature of the diffuse gas was found to be 0.62 ± 0.32 keV. The V-I color map as well as extinction map revels the presence of nuclear dust ring at the centre of galaxy.

Extinction curve for this galaxy was found to run parallel to that of the Milky Way, with the dust grains smaller than the grains in canonical. Spectral energy distribution of this galaxy shows good fit at reduced χ^2 and exhibited very little star formation 4.16×10^{-4} $M_{\odot}$.

Spinel ferrite nanoparticles use in the treatment of water and wastewater: An overview

Dr. K. R. Desai[1*], Dr. J. Y. Kadam[1], Badhe S G.[2], Dr. S. A. Jadhav[1]

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ABSTRACT

Several studies, which have been carried out on water and wastewater treatment with spinel ferrite nanoparticles (SFNPs) and spinel ferrite nanocomposites (SFNCs) confirmed their utmost importance. In particular, SFNCs used for water and wastewater treatments are very stable, easily regenerated, and reused for several cycles without a loss of their properties; thereby leading to reduced treatment costs. In this review, the recent progress and potential applications of SFNPs/SFNCs for the removal of organic and inorganic contaminants through adsorption routes are critically reviewed. Furthermore, the application of SFNPs for extraction of various pollutants present in water for quantitative determination at trace levels in water and wastewater is thoroughly reviewed. Finally, this review also addressed the possible techniques of recovery and reuse, toxicity, research gaps, and the future perspective of SFNPs. Based on this review, it is possible to conclude that SFNPs and their derivative composites have the unlimited capacity to addressan array of problems encountered in water and wastewater treatment. However, the practical application of SFNPs on a large scale still needs to be studied and evaluated.

Keywords: Magnetic nanoparticle; Spinel ferrite; Wastewater; Adsorbent; Analyte extraction

Raman effect and applications of Raman effect in the study of nanoparticles

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ABSTRACT

Nanoparticles have gained a lot of attention in recent years due to their unique properties and potential applications in various fields such as biotechnology, materials science, and electronics. To understand their properties and behavior, it is essential to study their vibrational modes using spectroscopic techniques, and Raman scattering is one of the powerful techniques. The Raman effect has numerous applications in the study of nanoparticles. One of the most important of these is in the characterization of the vibrational modes of nanoparticles. By analyzing the Raman spectra of nanoparticles, researchers can identify the different vibrational modes present in the material and determine its chemical composition. The current manuscript explores the Raman effect and its applications in the study of nanoparticles.

Keywords: nanoparticles, Raman effect, vibrational modes

The structural and optical properties of CoFe2O4 Nanoparticles prepared by Sol - gel auto-combustion technique

J. S. Shilwant1, M. R. Patil[1], S. B. Patil[1], A. N. Ardad[1], R. R. Mistry[1], S. D. More[1]

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ABSTRACT

Crystalline, magnetic, cobalt ferrite nanoparticles were synthesized from an aqueous solution containing metal nitrates and citric acid as a fuel agent by sol gel auto-combustion followed by calcination at temperatures from 650 °C for 5 hrs. The structural characteristic of the $CoFe_2O_4$ was determined by X-ray diffraction (XRD), and optical properties (UV-Vis). The X-ray diffraction (XRD) analysis clearly designates the establishment of single-phase cubic spinel geometry (*Fd3m* space group). The optical band gap energy (*Eg*) can be simply of $CoFe_2O_4$ tuned declines from 2.054 eV viewing the semiconducting performance.

Key wards: Synthesis; Sol-gel auto-combustion; XRD; and UV-Vis

Glycine Assisted Sol-Gel Synthesis and Investigations of Structural and Optical Properties of Cobalt Titanium Spinel Ferrite Nanoparticles

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ABSTRACT

The cobalt ferrite is a unique spinel ferrite with excellent structural, electrical, magnetic and optical properties. Here, attempt is made to modified the properties of cobalt ferrite by doping Ti^{4+}ions. The synthesis of $Co_{1+x}Ti_xFe_{2-2x}O_4$ (x = 0.0, 0.10, 0.20) was carried out at nanoscale using glycine assisted sol-gel auto-combustion route. The phase purity and crystal structure determination studies were carried out using X-ray diffraction (XRD) technique. The room temperature XRD patterns show the presence of diffractions peaks namely (220), (311), (222),(400), (422), (511), (440)which belongs to cubic spinel structure. No extra peak other than these diffraction peaks indicate the single-phase formation of all the samples under investigation. The nanocrystalline nature of the prepared samples was confirm through crystallite size values which is of the order of 12 nm, 16nm 15nm for x = 0.00, 0.10, and 0.20 respectively. The lattice constant calculated from XRD data increases from 8.3835 (Å) to 8.3907 (Å). The dislocation density and stacking fault do not show any systematic trend. The optical property were studied through UV-Visible spectroscopy technique. The band gap calculated from Tauc plot was of the order of 1.85 eV, 1.98 eV and 2.07 eV for x = 0.00, 0.10, and 0.20 respectively.

Keywords: Cobalt Ferrite, Ti Doping, XRD, Dislocation Density, Optical Band Gap

Impact of In3+ -Al3+ co-substitution on the structural, infrared and magnetic property of cobalt ferrite.

Rupesh Y. Kokate[1*], Shivaji Raut[2], R. B. Kawade[3], R. G. Vidhate[4] , S. V. Kshirsagar[5]

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ABSTRACT

Here, we report the synthesis of pure cobalt ferrite ($CoFe_2O_4$) and In^{3+}-Al^{3+} co-substitution cobalt ferrite using sol-gel auto-combustion method with a view to understand the impact of In^{3+}-Al^{3+} co-substitution. X-ray diffraction (XRD) analysis proves the single-phase formation along with cubic spinel structure. No impurities phases are observed in the XRD pattern. The cubic spinel structure's diffraction peaks (220), (311), (222), (400), (422), (511), and (440) are seen in the XRD patterns. The crystallite size value 22 nm of the produced sample, calculated using the Debye Scherrer formula, indicates its nanocrystalline nature. Standard relation was utilized to determine lattice strain (ε), unit cell volume (V), X-ray density (dx), and lattice constant (a). The features of the spinel structure and the two absorption bands, υ_1 and υ_2, which are utilized to determine the force constant, are revealed by the FTIR spectra. The magnetic parameters of the prepared samples were analyzed by recording the room temperature M-H plot using vibrating sample magnetometer in the applied magnetic field. The large magnetization and low corecivity values suggest superparamagnetic behavior.

Keywords: Cobalt Ferrite, In3+-Al3+ co-substitution, Lattice Strain, FTIR, Superparamagnetic

Azadirachta indica encapsulated Ni-doped α-Fe2O3 nanoparticles to enhance the photocatalytic activity

Pankaj Kumara[1], and Naveen Thakura[1*],

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ABSTRACT

In this study, co-precipitation method was employed to synthesize and characterize Ni-doped α-Fe_2O_3 (hematite) nanoparticles, focusing on their photocatalytic properties. Iron oxide nanoparticles (IONPs) were successfully synthesized using a biogenic approach, utilizing a non-toxic leaf extract of *Azadirachta indica* (neem) as a reducing and stabilizing agent. Various analytical techniques including X-ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM), FT-IR spectroscopy, ultraviolet-visible (UV-Vis) spectroscopy, and vibrating sample magnetometer (VSM) were utilized to analyze the synthesized materials. The synthesized doped α-Fe_2O_3NPs exist as cubic and rhombohedral crystal lattices with spheroidal shapes having ferromagnetic properties for hematite phases, respectively.UV-Vis absorption tests revealed an increase in the band gap value with a decrease in particle size, from 2.26 eV for chemically synthesized α-Fe_2O_3 to 2.5 eV for green Ni-doped α-$2O_3$ nanoparticles. Moreover, magnetic characterization indicated ferromagnetic behavior.Furthermore, the photocatalytic efficiency of the Ni-doped α-Fe_2O_3 particles was evaluated using malachite green (MG) dye as a surrogate for industrial wastewater dye. The results demonstrated that both green synthesized Ni-doped α-Fe_2O_3 nanoparticles achieved significant discoloration of MG, with approximately 92% discoloration observed after 70 minutes of exposure.

Keyword: Doping; α-Fe2O3; Magnetic; Nanoparticles; Photocatalytic activity

Ferrite and their applications.

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ABSTRACT

Researcher has great interest in ferrites due to their wide range of applications in many areas. Ferrites and their applications constitute a developing field. Ferrite is highly useful material for several electrical and electronic applications. It finds applications in almost every household appliance like mobile charger, LED bulb, TV, refrigerator, juicer mixer, washing machine, iron, microwave oven, mobile, laptop, desktop, printer and so on. This paper gives information about ferrite, their classification and applications. It is useful resource for students and scientists working in the field of ferrites.

Keywords: Spinel, Coercivity, resistivity, permeability.

Synthesis and structural characterizations of calcium doped nickel ferrite nanoparticles

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ABSTRACT

The present paper reports the synthesis of calcium doped nickel ferrite nanoparticles having the formula $Ni_{1-x}Ca_xFe_2O_4$ (x=0.00, 0.10, 0.20) using low temperature cost effective sol-gel auto-combustion method. Citric acid ($C_6H_8O_7$) was taken as chelating agent. The metal nitrate to chelating agent ratio was taken as 1:3. The as synthesized powder was annealed at 600° C for 6h to remove the moisture and impurity if any present in the sample. The annealed samples were characterized by X-ray diffraction technique (XRD). The X-ray diffraction patterns show the intense and slightly broader diffraction peaks. All the diffraction peaks were indexed using Bragg's law. No impurity peaks were observed in the XRD pattern. The single-phase formation with cubic spinel structure was observed through XRD analysis. The maximum intensity peak (311) was used to determine the full width at half maxima (FWHM). The crystallite size obtained through Debye Scherrer equation 14 to 20 nm. The lattice constant (a), unit cell volume (V), X-ray density (d_x) and lattice strain (ε) were calculated using the standard relation. The lattice constant (a) goes on increasing with the doping of calciumdue to larger ionic radii of calcium ion. The hopping length (L_A and L_B) also increases with increasing lattice constant. The interionic distances also increasewith increasing calcium doping. In summarizing, the structural properties of nickel ferrite are greatly affected by calcium doping.

Keywords: Nickel Ferrite, Calcium Doping, Lattice Constant, Hopping Length, Interionic Distances

Synthesis and Characterization of Graphene Oxide using the Hummers Method: A Short Review

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ABSTRACT

This research paper presents a short review on the synthesis and comprehensive characterization of graphene oxide (GO) by using Hummer's method. We have studied here the Equivalent Hummers Method. The synthesis method involved the oxidation of graphite to produce graphene oxide. A typical reducing agent gives the information of GO that can be followed by thorough analysis using various characterization techniques. X-ray Diffraction (XRD) was employed to investigate the crystalline structure and interlayer spacing of the synthesized graphene oxide. Ultraviolet-Visible (UV-Vis) spectroscopy provided insights into the electronic structure and optical properties. Raman spectroscopy was utilized to assess the degree of oxidation and structural defects in the graphene oxide sheets. Fourier Transform Infrared (FTIR) spectroscopy was employed to study the functional groups and chemical bonding present in the synthesized material. Additionally, Differential Scanning Calorimetry (DSC) was employed to examine the thermal behavior and stability of the graphene oxide. The combined use of these characterization techniques allowed for a comprehensive understanding of the structural, optical, vibrational, and thermal properties of the synthesized graphene oxide. The results contribute to the advancement of graphene oxide synthesis techniques and offer valuable insights for its potential applications in various fields, including nanotechnology, materials science, and biomedical applications.

Effect of Bandgap on Photocatalytic activity of GO Based Cr Doped NiO Nanocomposites

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ABSTRACT

In the current study, co-precipitation method was used to preparation of GO-based Pure NiO and 6% Cr-doped NiO nanocomposites. Field Emission Scanning Electron Microscopy (FESEM) and x-ray diffraction (XRD) techniques were used to investigate the impact of Cr doping on the structural characteristics of nanoparticles. The sample's crystalline and crystal structure were evident in the XRD spectrum. Nanoparticle morphology is observed using FESEM. EDAX spectroscopy was utilized for elemental analysis. Optical characteristics were confirmed by using UV-Vis spectrometer. The distinct features of GO based 6% Cr-doped NiO nanocomposite synthesized by co-precipitation has utilised in dye degradation

Synthesis and characterization of Lanthanum doped perovakite oxide by usingSolgel method.

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ABSTRACT

Currently, Lanthanum doped cobaltite nanoparticles were synthesized by using solgel method. Thesynthesized nanoparticles are nanocrystalline in nature and their other properties has beenstudied such as optical,structural,morphological properties and application in degradation of dyes. The optical properties of synthesized nanomaterial were studied using UV – Visible spectrometer with the maximum wavelength at 266 nm. And using the X-Ray diffraction method, the particle size was calculated as 19 nm. The morphology of material is studied by using FE - SEM and elemental composition detected by EDS. The synthesized nanoparticles degraded dye within 180 min.

Keywords: CoO3 Nanoparticles, Sol-Gel method.

Effect of co-substitution of chromium metal ions and yttrium rare earth ion on the structural and infrared properties of cobalt spinel ferrite nanoparticles

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ABSTRACT

The magnetic nanoparticles of pure and substituted cobalt ferrite are currently important because of their various applications in the field of medical science, magnetic sensor, catalyst, etc. In the present study, pure cobalt ferrite and chromium (Cr^{3+}) and Yttrium (Y^{3+}) co-substituted cobalt ferrite nanoparticles($CoFe_{2-x}Y_{x/2}Cr_{x/2}O_4$, x=0.00, 0.04) were preparedusing sol-gel auto-combustion method. The phase purity and structure was analyzed through X-Ray diffraction (XRD) technique. The analysis of XRD pattern indicates the monophasic cubic crystal structure. The average crystallite size of the order of 22 nm –19nm was obtained through Debye Scherrer equation. The unit cell parameter (a) calculated from XRD data was found to be vary between 8.386Å to 8.383 Å.The other structural parameters such as unit cell volume, X-ray density and lattice strain determined through XRD data show strong dependence of Cr^{3+}-Y^{3+} co-substitution. Fourier Transform Infrared Spectroscopy (FTIR)studies revealed two absorption bands, characteristics of spinel structure. The absorption bands υ_1 and $\upsilon_2$are used to determine the force constant. The Debye temperature (θ_D) obtained from FTIR data is in good agreement with the reported data.

Keywords: Cobalt Ferrite, Cr-Y co-substitution, Single Phase, Lattice Constant, Debye Temperature.

The effect of low energy 0-30 KeV irradiation on polycarbonate thin sheet.

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ABSTRACT

N^+ ions of low energies ranging from 0-30keV with a constant fluence of 1.98 x 10^{16} ions/cm^2 were irradiated on polycarbonate (PC) thin sheets. The virgin and irradiated samples of PC were further characterized using X-ray diffractometer (XRD), Ultra Violet Visible (UV-Vis), Raman and Fourier Transform Infrared (FTIR) spectroscopy. The XRD studies of PC were used to calculate crystallite sizes and micro-strains that show the changes in the polymer structure and the surface. UV absorbance spectrum show the optical band gap energy was decreased significantly from 2.9eV to 1.59eV while Urbach energy was increased confirming the creation of disorder produced in the surface of PC due to the ion irradiation. The analysis of FTIR spectra revealed the deviations in the intensities of the peaks of C-O, C-H, C=C and C=O bonds. The variations correspond to the molecular bond in the Raman analysis also suggest the cross linking and the polymeric chain scissoning in the case of PC.SRIM-13 software study was done to find the projected range as a function of ion energy.

Keywords: Ion irradiation, PC, Cross-linking, chain scissoning, SRIM-13.

Effect of Cd2+ on the Structural and Magnetic Properties of Lithium-Nickel Ferrite Nanoparticles

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ABSTRACT

Nano structural Lithium Nickel Ferrite doped with Cadmium nanostructured with formula Li0.4-x/2Ni0.2CdxFe2.4-x/2O4, (x = 0.5) was synthesized by Sol-Gel auto-combustion method. The analysis of X-ray diffraction pattern confirms the formation of cubic spinel structure with phase group Fd-3m phase (227). By using X-ray the lattice parameters were calculated 8.32 Å. The saturation magnetization (Ms), magnetic retentivity (Mr), Coercivity (Hc) of Li0.4-x/2Ni0.2CdxFe2.4-x/2O4, (x = 0.5) is found which shows the material is suitable for fluidic applications.

Keywords: Spinel Ferrite, Sol-gel, lattice Parameter,Structural Properties, Magnetization.

Advancements and Applications of Nanotechnology: A Comprehensive Review

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ABSTRACT

The unique size-dependent characteristics of metal nanoparticles (NPs) and their wide range of applications in optoelectronics and other fields have attracted a lot of attention. Anextensive summary of the production processes, characterization methodologies, and optoelectronic uses of metal nanoparticles is given in this paper. The physical, chemical, and biological methods for synthesizing metal nanoparticles are covered in depth, along with their benefits, drawbacks, and most recent developments. The size, structure, and stability of nanoparticles are explained, highlighting the significance of managing these parameters for customized optoelectronic features.

Understanding the structural, optical, and electrical properties of metal nanoparticles depends heavily on characterization techniques. This paper provides insights into nanoparticle morphology, crystallinity, composition, and surface chemistry by outlining typical characterisation techniques like electron microscopy, X-ray diffraction, spectroscopy, and surface analysis approaches. Moreover, the optoelectronic uses of metal nanoparticles—such as photovoltaics, photocatalysis, light-emitting diodes, sensors, and plasmonics—are investigated. Metal nanoparticles' special optical and electrical characteristics allow for improvements in light manipulation, emission, and absorption, which improves device performance and opens up new functions.

Keywords: Nanomaterials, Nanoelectronics, Nanomedicine, Nanophotonic, Nanotechnology in Energy, Environmental Applicationsetc.

A Review of Synthesis Methods, Properties, and Applications of Nanoparticles

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ABSTRACT

Method of preparation play an important role in the different synthesis methods, properties, and applications of nanoparticles. Nanoparticles have unique properties that distinguish them from their bulk counterparts due to their small size, high surface area to volume ratio, and quantum confinement effects. The synthesis of nanoparticles can be classified into two major categories: bottom-up and top-down methods. There are different methods available to synthesize nanoparticles such as chemical precipitation, sol-gel, microemulsion, high-energy ball milling, and laser ablation method, each with its own advantages and disadvantages. Nanoparticles have found a variety of applications in various fields such as medicine, electronics, and energy. However, their unique properties may pose potential risks to human health and the environment, making it crucial to understand their behavior and interactions. Understanding the properties of nanoparticles is essential for the development of safe and effective applications of these materials.

Keywords: Nanoparticles, chemical precipitation, micro-emulsion, development

Flood Mapping Using Microwave Remote Sensing

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ABSTRACT

In early July 2023, Himachal Pradesh, India, faced extensive flooding caused by exceptionally heavy rainfall, exceeding 220 mm. The rising water levels in rivers surpassed their danger thresholds, resulting in widespread flooding. Numerous areas in the state suffered severe damage to land and property, leading to loss of lives. India's distinct rainfall patterns make it susceptible to flooding, emphasizing the need for precise information to manage disasters effectively.

This study introduces a simple yet effective approach to identify regions affected by flooding and monitor changes. Sentinel-1A SAR data from both pre-flood and during-flood images of Bilaspur District (HP) were analyzed. SAR data proves adept at detecting water bodies on surfaces and within flood-prone areas due to its sensitivity to specular reflection, resulting in reduced backscattered energy as a significant portion disperses away from the sensor. Conversely, areas without water exhibit increased returns due to surface irregularities. Through preprocessing and the application of a thresholding method, flood-affected areas were isolated. A comparison of these results with meteorological department records underscores the efficacy of SAR data in flood detection and surveillance.

Keywords: SAR, Thresholding, Flood Detection.

Synthesis and Study of Cation Distribution of Copper Substituted Nickel Spinel Ferrite

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ABSTRACT

The polycrystalline samples of ferrite having the general formula Ni1-XCuXFe2O4 with x = 0.0, 0.5, 1.0 were synthesized using solid state reaction technique. The X-ray diffraction patterns revealed the formation of single-phase cubic spinel structure for x = 0.0 and x = 0.5. The lattice constant increases with copper content and shows tetragonal structure for x = 1.0 (CuFe2O4). X-ray intensity ratios were calculated for selected planes (220), (311), (440), (422), (333) and was compared with the observed intensity ratios in order to obtain cation distribution. The results of the cation distribution indicate that Cu2+ and Fe3+ occupy both sites whereas Ni2+ occupy octahedral [B] site.

Keywords: X-ray diffraction, lattice constant, cation distribution.

Estimating Soil Moisture Content of Bare Soil Using Oven Drying Method

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ABSTRACT

The moisture content of soil is a pivotal factor influencing soil behavior. To analyze the variability of soil water content across different locations, soil samples were collected from seven points within a 3642 m2 area located on Rakshashbhuvan Tamba. The moisture content of these samples was measured using an oven heating method at 140°C, with intervals of 4.30 hours. The study aimed to assess the accuracy and drying time efficiency of the convection oven in determining soil moisture content. The convection oven proved to be effective for accurately measuring moisture content. The investigation also explored the use of a microwave oven for soil drying, highlighting its timeliness, efficiency, precision, and safety. The microwave oven emerged as the most convenient tool for soil drying, offering a significant reduction in the complexity, time, and cost associated with traditional lab tests. This article focuses on the effect of temperature on soil moisture content using microwave radiation.

Keywords: Soil sample, moisture content, drying oven method.

Dielectric properties of Li+ doped Cobalt ferrite nanoparticles

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ABSTRACT

Now a day spinel ferrite nonmaterial's are studied more due to their widespread applications in the electronics industry and energy storage devices. The Li+ doped Cobalt ferrites with the general formula Co1+xLixFe2-xO4 (x =0.0, 0.1, 0.2, 0.3, 0.4, 0.5) were prepared using wet chemical method i.e. sol-gel auto combustion method. Structural characterization of the samples was carried out using X-ray powder diffraction technique. The XRD confirmed the cubic phase of Co1+xLixFe2-xO4 ferrite with the crystallite size. The dielectric properties were studied over the frequency range from 100 Hz to 1 MHz by using LCR-Q meter (HP 4248A). The dielectric measurements were performed at room temperature as a function of frequency. It is observed that all samples demonstrate dielectric dispersion where the dielectric constant (ε') decreases in an exponential way with an increase in frequency. The present work was to dielectric properties of Li+ doped Cobalt ferrite using citrate assisted sol-gel auto combustion and to understand the effect of Li+ ion doping on the structural properties cobalt ferrite.

Keywords: X-ray diffraction, Sol-gel auto combustion, dielectric constant (ε'), dielectric loss (ε''), Dielectric loss tangent.

A Review of Modelling Approaches for Drought Index Monitoring and Assessment Using Multispectral Imaging

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ABSTRACT

This paper explores the application of remote sensing, utilizing drought indexes, for effective monitoring and assessment of drought variables. The increasing availability of multispectral images, driven by rapid advancements in remote sensing technology, broadens the scope of this field. Droughts, as natural disasters, exert profound impacts on environmental factors such as agriculture, vegetation, human populations, wildlife, and local economies. Historically, an estimated 55 million people globally face the annual repercussions of droughts, leading to heightened concerns about food security due to escalating crop failures. Farmers grapple with compounded challenges, utilizing satellite multispectral and thermal band data to extract drought-related variables, including precipitation. Optical remote sensing technology emerges as a crucial tool in addressing these challenges, providing valuable insights into diverse land characteristics, and contributing to advancements in agricultural management and vegetation analysis. This paper comprehensively reviews and discusses various types of drought indexes based on multispectral data, utilizing different freely available satellite multispectral datasets such as Sentinel-2 data, Landsat, and MODIS.

Keywords: Drought, Multispectral images, Drought Indexes, optical remote sensing

Intermolecular Interaction Study of Binary Mixture of 2-Ethoxyethanol and Methanol Using Ultrasonic Interferometry

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ABSTRACT

This paper investigates the physical and chemical behavior of binary mixtures containing 2-ethoxyethanol and methanol, offering valuable insights into their complex interactions. Through systematic analysis of experimental data, significant variations in properties such as density, ultrasonic velocity, viscosity, and refractive index were observed across different mole fractions of 2-ethoxyethanol. These findings highlight the intricate relationship between composition and properties in binary mixtures, with implications for fields such as chemical engineering and materials science. The study underscores the importance of understanding molecular behavior in binary systems and lays the groundwork for future research aimed at optimizing processes and applications involving similar solvent mixtures. Overall, this research contributes to advancing our understanding of binary mixtures and informs efforts towards more efficient and sustainable industrial practices.

Keywords: Binary mixtures, 2-ethoxyethanol, Methanol, Molecular interactions, Viscosity.

Analysis of Structural Properties of Vanadium Substituted Yttrium Iron Garnet

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ABSTRACT

The garnet having the general formula Y3VxFe5-xO12 (x= 0.0, 0.2 and 0.4) were synthesized using double sintering ceramic technique. The samples were characterized by X-ray diffraction technique. The X-ray diffraction studies of compositions revealed the formation of single phase cubic structure with lattice constant ranging from 12.364 to 12.381 Å up x=0.0 to x= 0.4.

The IR spectra of all samples are taken in the range of 300-800cm-1. IR spectra show typical absorption bands indicating the garnet nature of samples.

Keyword: Garnet, Vanadium, structural, IR study.

Structural and Elastic Properties of Cadmium Substituted Ni - Cu Spinel Ferrites

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ABSTRACT

The cadmium substituted samples of Ni-Cu mixed ferrites having the generic formula Ni0.5Cu0.5-xCdxFe2O4 (x = 0.0, 0.3, 0.5) have been synthesized by standard ceramic technique using AR grade (NiO, Fe2O3, CuO, CdO) oxides. The analysis of X-ray diffraction and Infrared spectroscopic data confirms the formation of single phase cubic spinel structure of ferrite phase. The lattice constant was found to increase with increase in cadmium content and was due to the large ionic radius of cadmium. The structural parameters such as lattice constant, X-ray density, cation distribution, ionic site radii, oxygen positional parameter, theoretical lattice constant, bond length, jump length of tetrahedral (A) site as well as octahedral [B] site, tetrahedral edge length, shared and unshared octahedral edge length was estimated. The estimated cation distribution of ferrite was verified by comparing the observed and theoretical lattice parameters. The elastic parameter of ferrites such as young's modulus, rigidity modulus and bulk modulus was estimated by using IR technique.

Keywords: Elastic properties, Structural Properties, X-ray diffraction.

To Study Photovoltaic Application Of Zns Thin Films Deposited By Spray Pyrolysis Technique

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ABSTRACT

Thin films of ZnS were prepared by spray pyrolysis. The effect of substrate temperature on structural, Optical and electrical properties of ZnS thin film were studied. The X-ray diffraction shows at a substrate temperature of 400°C, ZnS thin films are appears almost in well-crystallized cubic phase obtained. The optical band gap for ZnS thin films at temperature 300° C -450°C were calculated to be 3.0-3.5 eV. The electrical resistivity is of the order of 1.63×10 2-cm at substrate temperature 400°C. Therefore, spray deposited ZnS thin films may be applicable for Photovoltaic solar Cell, Electronic Semiconductor devices, LED'S, Anti reflection Coating and Storage battery.

Harnessing Renewable Energy: A Path Towards Sustainable Future

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ABSTRACT

Renewable energy technologies have emerged as vital solutions in the global effort to mitigate climate change and reduce dependence on fossil fuels. This comprehensive review explores the key renewable energy sources including solar, wind, hydro, biomass, geothermal, and tidal energy. It examines their potential, technological advancements, environmental impacts, economic considerations, and challenges. By delving into the latest research and developments, this paper aims to provide insights into the role of renewable energy in transitioning towards a sustainable future.

Keywords: Renewable energy, solar energy, wind energy, biomass, tidal energy, sustainable future

Structural and Magnetic Study of Chromium Substituted Copper Zinc Ferrite Prepared by Egg White Method.

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ABSTRACT
Cr^{3+} substituted Cu-Zn ferrite system having general formula $Cu_{0.7}Zn_{0.3}Cr_xFe_{2-x}O_4$ (x=0.0 to x=1.0) were synthesized by egg white method using metal nitrate. The structure nature of prepared samples was characterized by x-ray diffraction XRD. Structure of sample is single phase cube with space group Fd3 m ,lattice constant increase up to x=0.2 then decrease with increase in Cr content x. Particle size carried out using XRD data in range 25 to 35 nm which conform nanoparticle. The magnetic properties such as saturation magnetization and magneton number both are decreasing with increase of chromium concentration *x*. The decrease in saturation magnetization and magneton number is attributed to the substitution of the Cr^{3+} ions. Curie temperature (T_C) from susceptibility plot is found to decrease with Cr concentration *x*. The result obtained on the structural and magnetic properties Cr^{3+} substituted Cu-Zn ferrite is reported in this paper.

Key words: Ferrites, Egg white method, XRD, a.c. susceptibility.

VSM Analysis of $CoFe_{2-2x}Ti_xMn_xO_4$ Nanoparticles

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ABSTRACT

The distinct compositions of $Co_{1-x}Cd_xFe_2O_4$ (x= 0.0, 0.1, 0.2, 0.3, 0.4, 0.5) samples were prepared by using the sol-gel auto combustion method characterized to understand their physical and magnetic properties. The X-ray diffraction (XRD) analysis shows the existence of a single-phase cubic spinel structure with an increase of lattice constant as Cd content increases. The magnetic properties of the $CoFe_{2-2x}Ti_xMn_xO_4$ (x = 0.00, 0.05, 0.10, 0.15, and 0.20) nanoparticles were investigated using a vibrating sample magnetometer (VSM) technique at room temperature and a magnetic field of 5 KOe. The magnetic properties such as saturation magnetization, magnetic moment, squareness ratio, coercivity, and anisotropy constant are reported. The M-H curve shows the reduction in coercivity while enhancement in saturation magnetization with the substitution of Cd^{2+} ions in the Co-Cd ferrite, low coercivity value of ferrite have soft. Such materials are interesting from the applications point of view in recording media; magnetic tape and coating technology to minimize energy loss.

Keywords: Sol-gel, X-ray diffraction, Lattice constant, Magnetic, Nano ferrite.

CONDUCTING POLYMER MATRIX FOR DRUG RELEASE DEVICE

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ABSTRACT

Cutting edge scientific and technological research in the area of novel composite materials boosts the development of new analytical tools. The objective of paper is to synthesis conducting polymers x using Galvan static polymerization technique properties of a composite system in order to get novel structures and improved properties for electrochemical sensor applications.

Keywords: Conducting Polymers, Galvan static Polymerization Technique, Electrochemical Sensor Applications

Graphical study of Dielectric Properties of Ghughuwa Fossil National Park (M.P.) Saline soil C- Band Microwave Frequency.

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ABSTRACT

The study also includes measurement of dielectric properties for various percentages of moisture contents, 5%-35%, for 5% Fossil saline soil. The Shorted waveguide technique is used for dielectric measurements using automated C-Band microwave bench set up. The least square fitting technique is used to calculate dielectric constant, ε', and dielectric loss, ε & #39;& #39;, and errors in their measurements. From measured dielectric properties, emissivity and brightness temperature are theoretically calculated at different angles of incidence of moisture-contented soils using Fresnel equations. The laboratory data obtained are useful for the interpretation of data in remote sensing applications, particularly in agriculture. Keywords Saline soil, Fossil Dielectric properties, 5 GHz microwave frequency, Brightness temperature, Emissivity.

Advancements in Gamma-Ray Shielding: Materials, Methods, and Applications

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ABSTRACT
Recent strides in gamma-ray shielding have spurred innovation across materials, methods, and applications. Novel shielding materials, including high-density polymers and nanostructured composites, exhibit enhanced attenuation properties over conventional counterparts. Advanced computational techniques, such as Monte Carlo simulations and finite element analysis, enable precise design and evaluation of shielding structures, optimizing protection for specific radiation sources and environments. These developments find widespread application in diverse sectors, from nuclear power plants to medical imaging facilities, where safety and efficiency are paramount. In nuclear power, robust shielding ensures personnel safety and minimizes environmental radiation exposure. In medical imaging, compact and efficient shielding solutions enhance patient safety without compromising diagnostic accuracy. Moreover, in space exploration, lightweight yet effective shielding materials are crucial for mitigating radiation hazards during extended missions. Additionally, in homeland security, innovative shielding technologies play a vital role in mitigating radiological threats. Interdisciplinary collaboration and technological innovation continue to drive progress in gamma-ray shielding, promising further advancements in radiation protection across various domains.

Keywords: gamma-ray shielding, materials, methods, applications, novel materials, high-density polymers, nano structured composites, computational techniques, Monte Carlo simulations, finite element analysis, nuclear power, medical imaging, space exploration, homeland security, radiation protection.

ELECTRICAL PROPERTIES OF $Co_{1+x}zr_xfe_{2-2x}o_4$ SPINEL FERRITE NANOPARTICLES

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ABSTRACT

Zirconium substituted cobalt ferrites $Co_{1+x}Zr_xFe_{2-2x}O_4$ system with x = 0.0, 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6 were synthesized by sol-gel auto combustion method. Electrical properties of $Co_{1+x}Zr_xFe_{2-2x}O_4$ system were investigated in the temperature range 300 to 800 K using two probe technique. The pellets in circular shape with 10 mm diameter and 3 mm thickness with silver coating were used for the measurement of DC electrical resistivity. DC resistivity of all the samples decreases with increase in temperature exhibiting the semiconducting behaviour. The activation energy in paramagnetic region(E_p) is more than that of ferrimagnetic (E_f) region. The dielectric constant (ε), dielectric loss (ε'') and dielectric loss tangent (tan δ) decreases exponentially with increase in frequency and decreases with increase in zirconium content x.

Keywords: Cobalt Ferrite, DC Electrical Resistivity, Dielectric Properties

Effect of Cr^{3+}Substitution on Structural, Magnetic and Electrical Characteristics of Spinel ferrites

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ABSTRACT

Cr-doped Spinal ferrite samples were synthesized using the sol-gel auto-combustion technique. X-ray diffraction (XRD) was used to analyse these particles at ambient temperature. The structural qualities were examined before and after sintering. The FCC spinel structure was confirmed by XRD patterns on the samples. The crystallite diameters range from 30 to 70 nm. We measured the DC electrical properties based on composition. Scanning electron microscopy was utilized to study the surface morphology of the produced samples. The system for measuring thermoelectric power was devised, developed, and calibrated in the lab. The prepared samples had their thermoelectric power evaluated at room temperature. DC resistivity increased with the increase of Cr^{3+} content and reduced with an increase in temperature which shows the semiconducting characteristic of ferrites. The dielectric constant, dielectric loss, and tangent loss decreased with the increase in the Cr^{3+} concentration.

Keywords: Ferrites; Sol-gel; XRD; Dielectric constant; electrical resistivity; magnetic propertiesResistivity, Permeability, Permittivity, Coercivity.

Signal Processing of Microwave Synthetic Aperature Radar Dataset for Parameter Extraction

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ABSTRACT

Synthetic Aperture Radar (SAR) is a powerful remote sensing technique that can generate high-resolution images of the Earth's surface. SAR systems are particularly well-suited for applications in which high-resolution imagery is required, such as vegetation monitoring, land cover classification, and sea ice monitoring. The signal processing of SAR data involves several key steps, including pre-processing, image formation, and parameter extraction.

Synthesis and Thermophysical Characterization of Copper oxide-based Propylene glycol (CuO-PG) Nanofluid

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ABSTRACT

Copper oxide (CuO) nanoparticles synthesized using wet sol-gel auto combustion method. The prepared CuO nanoparticles was annealed at 600oC for 5h in a muffle furnace. X-ray diffraction technique (XRD) was used to investigate the phase purity and for determination of crystal structure. Room temperature X-ray diffraction pattern analyzed by means of Origin software. Single phase formation along with the nanocrystalline nature was confirmed through X-ray diffraction analysis. The annealed powder of CuO was used to prepare nanofluid. Water and propylene glycols were used as a base fluid to prepare CuO-PG nanofluid. Thermal conductivity and zeta potential measurement of prepared nanofluid for different volume fractions of CuO nanoparticles in base fluids were carried out for heat transfer application. The thermal conductivity as prepared CuO-PG nanofluid increases with nanoparticle volume fraction but its stability decreases with increasing volume fraction of nanoparticles.

Keywords: Copper oxide, XRD, Sol-gel, CuO-PG Nanofluid, Thermal conductivity, Zeta Potential.

Gamma irradiation of iron oxide nanomaterial: synthesis, characterization, and interaction of oxygen ions and Fe

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ABSTRACT

In the present work, nanostructures decorated with transition metal nanoparticles using ionizing radiation as a synthesis method in aqueous solutions represent a clean alternative to existing physical, chemical, and physicochemical methods. Gamma irradiation of aqueous solutions generates free radicals, both oxidizing and reducing species, all distributed homogeneously.Iron oxides are a group of minerals composed of Fe together with O and/or OH. They have high points of zero charge, making them positively charged over most soil pH ranges. Iron oxides also have relatively high surface areas and a high density of surface functional groups for ligand exchange reactions. In recent times, many studies have been undertaken on the use of iron oxides to remove harmful oxyanions such as chromate, arsenate, phosphate, and vanadate, etc., from aqueous solutions and contaminated waters via surface adsorption on the iron oxide surface structure. This review article provides an overview of synthesis methods, characterization, and sorption behaviors of different iron oxides with various oxyanions. The influence of thermodynamic and kinetic parameters on the adsorption process is appraised.

Keywords: Gamma irradiation, Iron oxide, thermodynamic, kinetic parameters

Nanostructured Organic Polyaniline thin film Prepared by Polymerisation Technique

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ABSTRACT

Nanostructured Organic Polyaniline (PANI) thin film, doped with an inorganic acid (HCL), on glass substrate was directly synthesized by using the in situ polymerization technique. HCL doped PANI thin film is sense LPG gas at room temperature. The optical and electrical properties of were studied by UV-Vis spectrophotometer and I-V Characteristics. The mechanism of formation of polyaniline on glass substrate was confirmed by UV spectroscopy.

Keywords: PANI, Polymerization, Optical and electrical.

Synthesis and Characterization of SnO_2 Nanoparticles

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ABSTRACT
Tin Oxide (SnO2) nanoparticles samples have been synthesized by chemical co-precipitation method. The samples were characterized by X-ray diffraction, UV-Visible absorption and scanning probe Microscope SPM. The X-ray analysis shows that the obtained powder is SnO2 with tetragonal rutile crystalline structure and the crystalline size in the range of 8-10nm. The SPM investigation reveals that the average particles size is 73nm. The optical band gap values of SnO2 nanoparticles were calculated to be about 4.3eV in the temperature 550 o C, comparing with that of the bulk SnO2 3.78eV, by optical absorption measurement.

Keywords: SnO2 nanoparticles, X-ray diffraction, Morphology, Optical Properties.

Green synthesis of MoO_3 nanoparticles for photocatalytic purpose by Reflux method

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ABSTRACT

The paper at hand discusses a green method for synthesis of pure MoO_3 nanomaterial for Photocatalysis under solar irradiation. The synthesis as well as the annealing under ambient atmosphere leads to the formation of oxygen vacancies leading to increased efficiency of Photocatalysis and decreased band gap of the material as seen by UV-Vis spectra. An appreciable degradation of MB dye was obtained in aqueous medium. The physical properties were determined by XRD, SEM, Raman spectroscopy and the compositional properties by EDS and Raman spectroscopy. The reaction kinetics and degradation was performed under natural conditions and an average temperature of 25-30^oC.

Mass Attenuation Coefficient and Molar Extinction Coefficient of 2-Amino-3-Nitropyridinein the Energy Range356KeV to 1330 KeV

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ABSTRACT

In present experimental study the mass attenuation coefficient and molar extinction coefficient of nonlinear optical material i.e. 2-amino-3-nitropyridine have been measured at 356keV to 1330 keV photons in narrow beam good geometry set-up by using NaI (Tl) Scintillation detector with resolution 8.2% at 662 keV. The mass attenuation coefficients were calculated at different photon energies and data of mass attenuation coefficient were then used to the total interaction cross section, and molar extinction coefficient of 2-amino-3-nitropyridine. The experimental results are found to be in good agreement with XCOM data.

Keywords: Mass attenuation coefficient, Molar extinction coefficient, Nonlinear optical material

Exploring the Frontier: A Comprehensive Review of Radiation Studies in Space

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ABSTRACT

Space exploration poses numerous challenges to human health, with radiation exposure being a significant concern. This comprehensive review synthesizes current research on radiation studies conducted in space, encompassing both manned and unmanned missions. It delves into the sources of space radiation, including galactic cosmic rays, solar particle events, and trapped radiation belts, and examines their potential health effects on astronauts. Various shielding strategies and mitigation techniques are evaluated for their efficacy in reducing radiation exposure during space missions. Furthermore, advancements in radiation monitoring technology and the development of predictive models are discussed, aiming to enhance our understanding of space radiation and its implications for long-duration space travel. This review provides valuable insights for future space missions, highlighting the importance of continued research and innovation in radiation protection for the safety and well-being of astronauts exploring the frontiers beyond Earth.

Key Words: Space Radiation, Exposure, Shielding