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ICNAN '19

2nd INTERNATIONAL CONFERENCE ON NANOSCIENCE AND NANOTECHNOLOGY

29th November - 1st December

CONFERENCE PROCEEDINGS

Organised by

Centre for Nanotechnology Research

Vellore Institute of Technology, Vellore, Tamil Nadu, India

Conference Proceedings of

ICNAN'19

2nd International Conference on
Nanoscience and Nanotechnology

29th November - 1st December
(Friday - Sunday)

Edited by

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Dr. G. VISWANATHAN
Founder & Chancellor
Former Member of Parliament
Former Minister, Govt. of Tamil Nadu
President, Education Promotion Society for India,
New Delhi

MESSAGE

I am delighted that the Centre for Nanotechnology Research (CNR) of Vellore Institute of Technology, Vellore is organising the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* from 29th Nov to 1st Dec, 2019. Undoubtedly, ICNAN'19 would provide valuable and informative ideas to researchers, students and industrial experts working in the field of nanoscience and nanotechnology. I am happy that the conference has received overwhelming response from academia and industry. I trust the event would create a platform for young researchers to network with peers and experts with the aim of exchanging new ideas, developing innovative concepts and promoting joint research collaborations in thrust areas.

I heartily welcome all the delegates representing various prestigious research institutions from India and abroad.

I thank the sponsors for their support.

The organisers have done a commendable job, and I appreciate their diligent efforts in making the event a grand one.

I wish the conference all success.

Best Wishes,

Dr. G. Viswanathan

Vellore-632 014

08.11.2019

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Sankar Viswanathan
Vice President

MESSAGE

I take this opportunity to welcome all the delegates for the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)*. The mission of this International Conference is to bring together active researchers from various disciplines of nanotechnology and to enable them to showcase their state-of-the-art research results, which would in turn lead to new cross-disciplinary interactions among the delegates.

ICNAN'19 has various sessions highlighting recent and niche areas of nanoscience and nanotechnology and thus provide opportunities to share information on current research. The interdisciplinary nature of this conference has attracted delegates from various parts of the globe to participate and deliver lectures in the cutting edge technologies related to thrust areas of nanoscience and nanotechnology. I sincerely thank all the sponsors for their contribution to this conference. I appreciate the organizing committee members for their hard work to make this conference a grand success.

I wish all the participants a fruitful experience at Vellore Institute of Technology, Vellore.

With warm regards,

Sankar Viswanathan

Vice President

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Dr. Sekar Viswanathan, PhD
Vice President

MESSAGE

I am happy that the Centre for Nanotechnology Research (CNR), Vellore Institute of Technology, vellore is organizing *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)*, from 29th Nov to 1st Dec, 2019. Sessions comprising keynote addresses, plenary/invited lectures and oral/ poster presentations have been planned as a part of the conference. The overwhelming response from the researchers all over the globe demonstrates the international reach of the conference. The selected publication of the peer reviewed articles in the Scopus indexed journals affirms the high quality of research findings to be shared in the conference. I am sure that the conference would serve as an appropriate stage for researchers, engineers and industrial entrepreneurs to share their knowledge and expertise in the domain of nanotechnology. It would also help them to forecast the potential of employing frontier areas of nanoscience and nanotechnology for diverse applications.

I extend my best wishes to the delegates attending the conference.

I congratulate the members of the organizing committee of ICNAN'19 on the good team work put forth by them.

I wish ICNAN'19 a grand success.

VIT, Vellore

Dr. Sekar Viswanathan

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Dr. Sandhya Pentareddy
Executive Director

MESSAGE

I take great pride in welcoming all the international and national presenters; academic and industrial delegates and sponsors to the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* which is to be held from 29th Nov to 1st Dec, 2019 organized by Centre for Nanotechnology and Research (CNR), VIT, Vellore.

ICNAN'19 aims to establish an interdisciplinary platform for sharing knowledge, ideas, recent trends, technological breakthroughs as well as innovations in the field of Nanotechnology for applications in the all areas of life. Energy, environmental and medical applications have emerged as strategic priorities in all aspects of our life. Worldwide research on nanomaterials has already been established and has shown promising results in offering solutions to each of these priority areas.

The conference will bring together various academic scientists from different countries, faculty members from different institutes, budding young researchers and industrialists to exchange their innovative ideas and expertise to explore the opportunities and gain new directions for research for a better and prosperous livelihood.

I am extremely delighted to welcome all the delegates to ICNAN'19 and wish you a wonderful stay at VIT Vellore.

I appreciate the organising committee of ICNAN'19 for their sincere efforts.

I wish the conference a great success.

Dr. Sandhya Pentareddy

Executive Director

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Ms. Kadhambari S Viswanathan
Assistant Vice President

MESSAGE

Greetings to you all from VIT on the occasion of the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* held at Vellore Institute of Technology, Vellore. The conference ICNAN'19 has been crafted to challenge the hurdles and we are fortunate to have leading speakers to share their experience and perspectives to achieve smart solutions through their innovation. I hope that the conference serves as a locus for interdisciplinary, a space for discourse and collaboration. I would like to express my appreciation to the organizing committee for their dedicated efforts to materialize the conference.

The conference (ICNAN'19) will serve the purpose of providing a great opportunity for the PhD student community and researchers to present their work and get exposed to experts who will inspire the researchers and give directions for the early and middle level researchers in their research journey. I extend a hearty welcome to all the experts who will enlighten us with their knowledge and share their experience by presentation and interaction in the conference. Let us actively participate in the discussion and take home the learning experience from this conference.

Wishing you all to have fruitful deliberations in ICNAN'19 at VIT, Vellore.

Ms. Kadhambari S Viswanathan

Assistant Vice President

VIT, Vellore

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Dr. Anand A. Samuel, BE,MS,PhD
Vice Chancellor

MESSAGE

I am glad that Centre for Nanotechnology Research (CNR) is organizing the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* at Vellore Institute of Technology, Vellore.

ICNAN'19 is a remarkable event which brings international academic scientists from various universities and industries together, thereby making the conference a perfect platform to share experience, foster collaborations across industry and academia and evaluate emerging technologies across the globe. ICNAN'19 unites applications from various scientific disciplines and represents the huge area where the focus lies on developing product-related technologies.

Nanotechnology is presenting possibilities which were never been imagined, for instance, realizing engineering devices with few atoms. Tremendous progress has been made thus far in the field of nanoscience and nanotechnology related to its research, design and development. However, significant challenges still remain and require further developments for maximum utility and widespread use of this domain. I believe this forum will be a driving force for discussing the futuristic view of nanoscience and nanotechnology.

VIT known for its research on nanotechnology and I believe that it is the right place to organize such an international event, where many well-known researchers from abroad and India come together for deliberations. I am sure that, this event will be a grand success and will create new ways for generation of innovative ideas. I congratulate the organizers for their commendable work in the organization of this conference. I wish all the delegates a productive and enjoyable stay at VIT.

May God Bless the conference!

Dr. Anand A. Samuel

Vice Chancellor

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Dr. S. Narayanan
Pro-Vice Chancellor

MESSAGE

I am happy to note that the Centre for Nanotechnology Research (CNR) has taken this initiative in organising the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* from 29th Nov to 1st Dec, 2019. I sincerely hope that ICNAN'19 will be of immense intellectual value to the participants, researchers and industry personnel. I appreciate the organizing committee for taking sincere efforts to publish the peer reviewed papers in Scopus indexed journals. This reflects the high impact research output that is expected of the conference. VIT has been steadily enhancing the quality of its research contributions to global standards, and ICNAN'19 is a true expression of this objective. I congratulate the organizers for raising the bar to make the event globally visible. I welcome all the speakers, delegates and student participants to ICNAN'19. I wish the conference all success.

Dr. S. Narayanan

Prof. S. Narayanan, Ph.D.,
Pro-Vice Chancellor
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Dr. K. Sathiyanarayanan
Registrar

MESSAGE

I am happy to learn that the Centre for Nanotechnology Research (CNR) is organizing the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* at Vellore Institute of Technology, Vellore. I take this opportunity to extend a hearty welcome to the Chief Guest and the Guests of Honour who have consented to grace the occasion. ICNAN' 19 provides opportunity to the researchers to enrich their knowledge through various sessions and interaction with the eminent researchers who share their knowledge with them during the conference. I congratulate the organizers of the ICNAN' 19 for their sincere efforts to bring the researchers together. I wish all the participants to actively take part in the conference, and trust that they will have the opportunity to acquire knowledge and share their ideas. I also wish the team ICNAN' 19 to make the event a grand success. I welcome all the guests, invited speakers, authors of papers and delegates. I hope that everyone will have a comfortable stay in the serene and scenic campus of VIT, Vellore. I offer my best wishes and appreciation once again for the organizing team.

Dr. K. Sathiyanarayanan
Registrar 5/11/19

REGISTRAR
Vellore Institute of Technology (VIT)
(Deemed to be University under section 3 of UGC Act, 1956)
Vellore-632 014, Tamil Nadu, India

Dr. Ada. E. Yonath

Weizmann Institute of Science, Israel

Nobel Laureate in Chemistry (2009)

MESSAGE

Greetings!

I congratulate Vellore Institute of Technology, Vellore for organising 2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19) scheduled from 29th Nov to 1st Dec, 2019.

I expect that this conference will lead to the identification of innovative ideas for overcoming the current problems of the society and industry by providing a single platform to brainstorms of the participating researchers and students, working in the broad areas of nanoscience and nanotechnology. I expect that the diverse dynamic speakers and panellists will provide new ideas and in-depth insights, alongside actionable and practical tools and new skills while showing their capabilities and discoveries to the world.

I appreciate all the members of the organizing committee who have been working with creative efforts to make this conference a grand success.

Dr. Ada. E. Yonath

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A.J. Drexel
Nanomaterials Institute

Drexel University
3141 Chestnut Street
Philadelphia, PA 19104
TEL 215-895-6446
FAX 215-895-1934

Dr. Yury Gogotsi
Drexel University, USA

November 9, 2019

WELCOME MESSAGE

It gives me immense pleasure to convey my best wishes to the Centre for Nanotechnology Research (CNR) of Vellore Institute of Technology, Vellore which is organising the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* from 29th November to 1st December, 2019.

On this occasion, I take the opportunity to congratulate the Conference Chairperson and all the Organizing Committee members for their sincere and dedicated contribution to make the conference a memorable and fruitful event.

I am confident, the scientific presentations, discussions and other activities that are going to be held during the conference period will be of great quality and will definitely produce new scientific insights. I wish the organizers the very best for the success of the Conference.

I look forward to seeing you all in Vellore Institute of Technology, Vellore.

Sincerely,

Yury Gogotsi, Ph.D., D.Sc., Dr.h.c.
Charles T. and Ruth M. Bach Distinguished University Professor of Materials Science & Engineering
Director, A. J. Drexel Nanomaterials Institute
Associate Editor, ACS Nano

Prof. Dr. Prasanth V. Kamat
Department of Chemistry and Biochemistry
Principal Scientist of Radiation Laboratory
University of Notre Dame, USA

Prof. Dr. A. Nirmala Grace
Director CNR
Vellore Institute of Technology
Vellore, TN, India.

MESSAGE

Prof. Dr. Prasanth V. Kamat would like to congratulate Centre for Nanotechnology and Research (CNR) of VIT for organizing the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)* scheduled for 29th Nov to 1st Dec, 2019 at VIT Vellore, India.

ICNAN'19 goal is to bring together, multi-disciplinary group of scientists and engineers from all over the world to present and exchange ideas relating to the Nanoscience and nanotechnology. No doubt the event has a broad scope of topics and continued in parallel sessions relative to the specific area of research. With its scientific sessions, the delegates are provided assurance to explore the latest technologies and breakthroughs that are specific to their area of work.

Prof. Dr. Prasanth V. Kamat and Prof. Dr. A. Nirmala Grace are looking forward to an excellent meeting with great scientists, sharing new and exciting results in field of Nanoscience and Nanotechnology.
We appreciate the organising committee of ICNAN'19 for their sincere efforts and We wish the conference a great success.

Prasanth V. Kamat

Nirmala A. Grace

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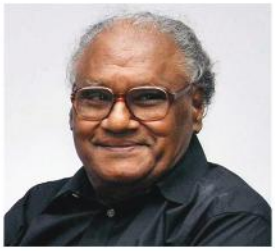

8 November 2019

MESSAGE

Nanotechnology has the potential to change the world and this emerging technology plays role in addressing the energy crisis. I am pleased to note that the Centre for Nanotechnology Research (CNR), VIT Vellore, is organizing the 2nd International conference on Nanoscience and Nanotechnology (ICNAN'19) during 29 November to 1 December 2019. I believe that this event will act as a forum for academia, industry and start-ups to exchange notes on recent developments in this field. This conference may provide platform for researchers to initiate on new collaborative research projects.

I appreciate the efforts of the conveners and organizers for their commendable work and wish every success for the conference.

'Doing Science is like a spiritual experience'

C.N.R. Rao
Linus Pauling Research Professor

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सत्यमेव जयते

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Secretary
Government of India
Ministry of Science and Technology
Department of Science and Technology

14th November, 2019

MESSAGE

Nanoscience and Nanotechnology is a front runner for the betterment of future human life. I am delighted that Centre for Nanotechnology Research (CNR), VIT Vellore is organizing an International Conference on Nanoscience and Nanotechnology (ICNAN-2019) during 29th November to 1st December, 2019.

ICNAN'19 collaborates among different researchers and technologists across the world. Invited speakers from reputed institutions and laboratories along with more than 300 delegates will make their presence felt with their unique set of experiences and multidimensional knowledge. This project is also taking an initiative to provide a platform to the young researchers by encouraging them with awards. I am sure that this conference will open up a new pathway to explore new ideas and links that will widen up the networks and opportunities for future to the young researchers.

I appreciate the efforts of the conveners and organizers in popularizing nanoscience and nanotechnology. My best wishes for a very successful conference.

(Ashutosh Sharma)

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Dr. A. Nirmala Grace
Director
Organizing Chair

MESSAGE

On behalf of the organizing committee, it is a great honour to welcome you to the *2nd International Conference on Nanoscience and Nanotechnology (ICNAN'19)*, organized by the Centre for Nanotechnology Research, VIT, Vellore during 29th Nov to 1st Dec, 2019. ICNAN'19 is aimed to provide a platform for researchers, scientists and industrialists across the globe to exchange, discuss the state-of-the-art research and identify the future demands and needs in the field of Nanoscience and Nanotechnology.

Our technical program is rich and varied with plenary talks, keynote and invited talks from renowned speakers across the globe. A special award for the Young researchers has been organized to encourage the researchers working in this area. Overall this conference will give the participants a lot of opportunities to explore, collaborate and discuss on the current and future trends of Nanotechnology.

I appreciate all the members of the organizing committee, steering committee, and program committee who have been working with creative efforts to make this conference a grand success. Special Thanks to all our speakers and we greatly value their participations and look forward to their insightful vision and thoughts. I would like to extend my most sincere thanks to the VIT management for their efforts and vision which provided the impetus to put together this outstanding technical program. The excellence and success of ICNAN'19 would not have been possible without the support of our sponsors and I greatly appreciate all our sponsors. I look forward to your participation, and wish everyone have an unforgettable stay at VIT, Vellore.

Dr.A.Nirmala Grace
Organizing Chair

VIT, Vellore

ABOUT VIT

Recognized as an Institution of Eminence by Govt. of India.
No. 1 Private University for Innovation as recognized by ARIIA, Govt. of India.

Vellore Institute of Technology (VIT) was established in 1984 as Vellore Engineering College by the Honourable Chancellor **Dr. G. Viswanathan** with the aim of providing quality higher education on par with international standards. From its humble beginning, the institution has grown to a premier educational institution with modest student strength of 39000 from 29 states and 7 union territories of India and 50 countries across the world.

Currently VIT has 4 campuses – in **Vellore, Chennai, Amaravati (AP) and Bhopal (MP)**. The National Institutional Ranking Framework (NIRF) of the MHRD, Government of India, has identified VIT as the best Private Engineering Institution in India in the year 2016 and in 2017. VIT has gone for accreditation by NAAC [India], IET [UK], and ABET [USA] and follows world class academic processes. VIT is the first and only in India to get 4 star rating from QS, the world universities ranking organization. The Industry consortium FICCI, has declared VIT as the **"University of the Year 2016"**, in India. VIT has also been ranked in the top 201-250 in QS BRICS Ranking in 2016 and in the top 251-300 in Times Higher Education (THE), Asia Ranking. With its strong academic partnerships with over 200 Universities around the globe, VIT excels in academics and research.

ABOUT CNR

The Centre for Nanotechnology Research (CNR) at VIT, Vellore was established in June 2008 and its faculties are actively engaged in teaching courses for the "**M.Tech. Nanotechnology**" programme and undertaking research projects for **M.Tech.** and **Ph.D.** Scholars. The M.Tech. Nanotechnology programme was initiated in 2006 by VIT.

VIT provided a generous support of about **INR 13 million** in setting up state-of-art Nanomaterial characterization and synthesis facilities for the Nanotechnology Lab. The M.Tech. Nanotechnology programme also received financial support of INR 29.4 million from the Department of Science and Technology, Government of India, New Delhi towards further enhancing infrastructure facilities of the Nanotechnology Laboratory and offering student fellowships and contingency grant for their research projects during the course.

The centre has received funds from various funding agencies like **DST, DRDO, IEEE** etc. Our research is focused on various niche areas of Nanoscience and Nanotechnology inline with the global needs and to cater the same, the centre is equipped with a team of inter-disciplinary faculty members. The centre has published more than 150 research articles in International Journals. The centre has recently extended its facilities for external researchers on a consultancy basis. **For further details: http://www.vit.ac.in/research/centers/nanotech.**

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Foreword

The International conference on Nanoscience and Nanotechnology, ICNAN'19, is being organised by the Centre for Nanotechnology Research, VIT University, Vellore during 29th November to 1st December. ICNAN'19 has received tremendous support and overwhelming responses globally. We have received more than 500 abstracts under various themes of Nanoscience and Nanotechnology. The conference covers broad theme which includes advanced inorganic/organic nanostructures, synthesis of functional nanomaterials, advanced characterization techniques, nanobiomaterials, nanomaterials for treatment of environmental hazards, nanomaterials and composites for catalysis and sensors, nanomaterials for energy harvesting, storage and conversion, nanoelectronics and nanophotonics: modelling, simulation to fabrication. This will accommodate wide range of interests and facilitate interdisciplinary collaboration with academia and industries.

The conference includes plenary, keynote and invited talks for three days of the conference. Apart from the talks, researchers will be given a platform to present their work in the form of oral/poster presentations. ICNAN'19 encourages the young minds by giving "Young Researchers Awards" which is an initiative with an intension of supporting young researchers in their quest to advance the frontiers of Nanoscience and Nanotechnology. The organizing committee has taken every measure to see that the conference is well organized. The program will have different sessions to facilitate a vast number of oral and poster presentations. The full text of the papers presented in the conference will be peer reviewed and considered for publications in various reputed journals. We extend a warm welcome to all the delegates and wish everyone a pleasant stay in VIT.

Highlights

- ***Plenary Lecture by Nobel Laureate***
- ***Lectures from renowned speakers***
- ***Scopus Indexed and Reputed Journal Publications***
- ***Thematic Sessions***
- ***RSC "Nanoscale & Nanoscale Advances" Poster Presentation Awards***
- ***ACS Poster Presentation Awards***
- ***Young Researcher Awards***
- ***Industrial Interactive Sessions***
- ***Expert discussion on Joint projects and Bilateral proposals (EU funding)***
- ***Round table session on recent scenario and future trends in Nanoscience and Technology***
- ***Virtual session for International participants***

Speakers of ICNAN '19

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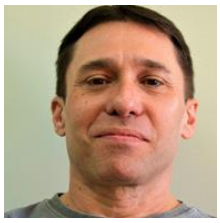
Dr. Gilberto Maia Institute of Chemistry, Federal University of Mato Grosso do Sul, Campo Grande, MS – Brazil *E-mail: gilberto.maia@ufms.br*	
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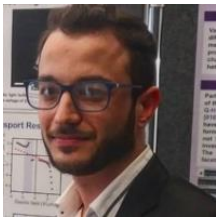
Mr. Servet Ozdemir University of Manchester, UK *E-mail: servetcanozdemir@gmail.com*	
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Invited Abstracts

From Basic Science to Modern Medicine

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Striving to understand the process of the translation of the genetic code, a basic and most important process of life, we determined the structure and deciphered the mode of function of the ribosome, the universal cellular "factory" that performs the formation of proteins according to their genetic code. Owing to their vital role in cell life, the ribosomes are targeted by many antibiotics. Focusing on ribosomes from harmless as well as of multi-resistant pathogenic bacteria, revealed the antibiotics binding modes, inhibitory actions and synergism pathways for almost all ribosomal antibiotics. These indicated the principles of differentiation between patients and pathogens, suggested mechanisms leading to bacterial resistance and paved ways for improvement of existing antibiotics as well as for the design of advanced therapeutics capable of minimizing antibiotics resistance.

The Rise of MXenes

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Numerous compounds, ranging from clays to boron nitride (BN) and transition metal dichalcogenides, have been produced as 2D sheets. Although many of these materials remain subjects of purely academic interest, others have jumped into the limelight due to their attractive properties, which have led to practical applications. Among the latter are carbides and nitrides of transition metals known as MXenes (pronounced "maxenes"), a fast-growing family of 2D materials. The family of 2D transition metal carbides and nitrides (MXenes) has been expanding rapidly since the discovery of Ti_3C_2 at Drexel University in 2011 [1]. More than 30 different MXenes have been reported, and the structure and properties of numerous other MXenes have been predicted using density functional theory (DFT) calculations [2,3]. Moreover, the availability of solid solutions on M and X sites, control of surface terminations, and the discovery of ordered double-M MXenes (e.g., Mo_2TiC_2), i-MAX phases and their MXenes offer the potential for producing dozens of new distinct structures.

This presentation will describe the state of the art in the field. The manufacturing of MXenes, their delamination into single-layer 2D flakes and assembly into films, fibers and 3D structures will be briefly covered. Synthesis-structure-properties relations of MXenes will be addressed on the example of Ti_3C_2. The use of MXenes in ceramic- metal- and polymer-matrix composites, smart fibers and textiles will also be discussed. The versatile chemistry of the MXene family renders their properties tunable for a large variety of applications [3-5]. Oxygen or hydroxyl-terminated MXenes, such as $Ti_3C_2O_2$, have been shown to have redox capable transition metals layers on the surface and offer a combination of high electronic conductivity with hydrophilicity, as well as fast ionic transport [4]. This, among many other advantageous properties, makes the material family promising candidates for energy storage and related electrochemical applications [4], but applications in plasmonics, electrocatalysis, biosensors, water purification/ desalination and other fields are equally exciting.

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Nanolubricants: From research bench to commercialization

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Reducing friction and wear in engines and machines has been a challenge. Conventional lubricants use chemical based additives which have reached threshold limits in-terms of tribological performance. Nanomaterials due to their multi-functional nature, offer tremendous potential to supplement existing additives. We have developed a range of nanoadditives ranging from carbon allotropes, MXene, hybrid nanoparticles, etc., to enhance the properties lubricant used in different applications. For instance, our graphene based additive is able to reduce engine wear by upto 30% and augment the thermal conductivity of the oil by over 17%. This could roughly translate to 10% reduction in overall maintenance and fuel cost. Our investigations reveal that graphene undergoes multiple tribo-morphological transformation simultaneously and/or subsequently while offering such performance. Though the subsequent path to commercialization seem straight forward, obstacles emerged in the form of graphene flakes dispersion stability, complicity of the additive with other engine oil grades and subsequent testing. This presentation will further discuss on the path to commercialization.

Magnetic Proximity Effects in Graphene and at EuO Thin Films Interfaces

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Graphene's electronic properties make it the material of choice for next generation electronic devices due to its high electron mobility at room temperature (RT). It has also a long spin-diffusion length due to its weak intrinsic hyperfine interaction and small spin-orbit coupling, which means that manipulating spins directly in a monolayer of pristine graphene is not straight forward. However, this can be overcome by using an induced proximity effect such as introducing an exchange-coupled interface between the graphene and a ferromagnetic layer.

Here, I report the induced magnetic moment in graphene as a result of the proximity effect in the vicinity of different ferromagnetic materials such as Co and Ni using polarised neutron reflectivity (PNR) and x-ray magnetic circular dichroism (XMCD) techniques. CVD growth parameters were tuned to produce epitaxial and rotated graphene domains. The PNR measurements yield an induced magnetic moment of 0.52 and 0.43 μ_B per C atom at RT on rotated and epitaxial graphene domains on Ni(111), respectively (Fig. 1). Two possible mechanisms are elaborated for the observed induced moment; the first is exchange interaction between the ferromagnetic substrate and graphene. The second, is the electron donation in the form of chemical bonding from the transition metal. Therefore, to clarify the origin of the measured magnetic moment in graphene, further PNR measurements were carried out on rotated graphene grown on top of a non-magnetic substrate (Ni_9Mo_1). I will also present XMCD results obtained on both; rotated and epitaxial graphene at the Carbon K-edge, which assists in determining the induced magnetic moment. We will also discuss the results of techniques used to characterize the structural and magnetic properties of the structures such as Raman, XRD, SQUID, SEM and XMCD-PEEM. Surprisingly, these results indicate a stronger effect for the rotated graphene.

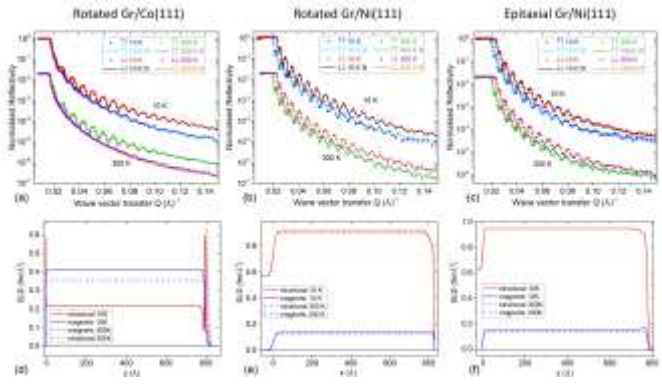

Fig. 1: The 10 K and 300 K PNR data fits and the corresponding Scattering Length Density (SLD) profile for the rotated graphene/Co(111) (a,d), rotated graphene/Ni(111) (b,e) and epitaxial graphene/Ni(111) (c,f).

EuO-based systems are expected to have a plethora of potential applications such as spin filters or magnetic qubits. This is due to the desirable properties of EuO: a ferromagnetic semiconductor with a high magnetic moment of 7 μ_B per Eu atom, a T_c of 69 K and a spin splitting of 0.6 eV in the 5d conduction band with a band gap of 1.2 eV at RT. We will discuss results obtained related to the creation of a 2D electron gas at the $EuO(001)/LaAlO_3(001)$ interface and briefly the recently determined role of spin mixing conductance in determining thermal spin pumping near the ferromagnetic phase transition in EuO_{1-x}.

Molecular Processes at the Nano-Scale on Insulating Surfaces: Kinetic Control and Covalent Interactions

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Ab initio density functional theory is used to characterize at nano-scale, several mechanisms of reaction, diffusion and structural transition involving a class of organic molecules (benzoic acid derivatives) as deposited on insulating calcite (10.4) [1-7]. The theoretical investigation is combined with experimental data obtained from non-contact AFM microscopy [3, 5, 6].
In the first part of the contribution, I will illustrate the fundamental principles driving a sequence of molecular transitions on calcite, from molecular deposition to the formation of stable and metastable ordered molecular networks [1, 2, 6]. The quantitative analysis highlights the role of kinetics, as the driving mechanism for the observed specific transition path. In view of this, I will propose kinetic control a route to increase the variety of molecular structures on insulating surfaces, which is still very challenging. In the second part, I will present several mechanisms of on-surface synthesis (based on covalent interactions) on calcite [4, 5]. In particular, a peculiar dimerization process [4, 7], revealing a possible role of the insulating substrate as a catalyst, in the total absence of a metallic agent.
The knowledge of reaction and diffusion mechanisms on insulators helps in identifying routes to create ordered molecular patterns with important technological advantages over structures routinely obtained on metallic surfaces.

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Towards Developing Energy Efficient Systems Based on Novel Nanocarbon Materials

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Minimizing friction and wear-related mechanical failures remains as one of the greatest challenges in today's moving mechanical systems leading to a search for new materials that can reduce friction and wear related energy losses and the understanding of fundamental mechanisms that control friction. In this context, our work on graphene has shown that its materials properties can be manipulated at the atomic level to achieve exceptionally high wear resistance, as well as well as achievement of superlubricity (or near zero friction) at macroscale through combined use of graphene and nanodiamonds on sliding surfaces [1]. This discovery presents a paradigm shift in understanding frictional behavior of 2D materials and offers a direct pathway for designing energy efficient frictionless tribological systems. In the second part of my talk, I'll describe our recent work on direct growth of wafer-scale graphene on diamond. The fact that the one atom thick graphene membrane strongly affected by the substrate interactions puts limit on exploiting excellent intrinsic properties of graphene for various applications. Diamond offers multiple unique properties, such as high phonon energy, low trap density, and high thermal conductivity, which makes it an ideal substrate for fabricating graphene devices on diamond [2]. We demonstrate a novel process to grow large area single and few layer graphene directly on the diamond thin film deposited on silicon wafer thus eliminating the need for graphene transfer [3]. This approach offers new opportunities for developing graphene based nanoelectronic devices on diamond.

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Multifunctional Nanostructured Hybrid Materials

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The multi-functional properties of nanoscale materials offer a wide range of opportunities for addressing several research and development challenges in the area of advanced technologies including renewable energy production, conversion and storage, environment and health care applications. Carbon derivatives such as Graphene, Graphene oxide and porous carbon have has received wide attention due to versatility of the materials in terms of nanophenomena. Amount these materials, Graphene (GNS) is expected to be an ideal candidate to design and development of hierarchical nanosystems for energy conversion and environmental related applications.

The focus of this lecture is on the fabrication and multifunctionality of Graphene-Metal Oxides and Graphene-Metal composites for different applications. The sunlight induced photocatalytic activities and supercapacitive properties of the graphene based hierarchical systems are also discussed. The challenges and the future prospective of Graphene based hierarchical nanosystems will be discussed in detail.

Novel N-Heterocyclic Carbenes as Functionalized Ligand for Nanomaterials: From Surface to Nanoparticles

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Organic ligands as stabilizing ligands for nanomaterials have been used for many years, such as thiols, amines, or phosphors. However, desorption of the stabilizing ligands from nanoparticles surface due to the heat or other chemical conditions remains problematic. In 2014, the Crudden group demonstrated that replacement of sulfur-based ligands with N-heterocyclic carbenes (NHCs) and resulting in an ultra-stable organic films on flat Au(111) surfaces.[1] Furthermore, they recently reported the bidentate NHC-functionalized gold nanoparticles and resulting the most stable NHC-functionalized gold nanoparticles up to the date.[2] Therefore, NHCs are shown great potentials as functionalized ligands for surface and nanoparticles.[3] In this presentation, we are going to present our recent findings in synthesizing NHCs-metal complex and further nanoparticles formations.

Keywords: N-heterocyclic Carbenes, Nanomaterials, Surface

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Fluorescent Capped Metal Nanoparticles for Environmental and Healthcare Applications

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At present, there is a great deal of interest in the design and development of materials capable of determining heavy metals and biological entities, which are well-known to play numerous fundamental roles in environmental, chemical and biological processes.[1] In this context, sensors that can detect and determine the environmentally and biologically important analytes and entities in aqueous environments and under physiological pH are of special significance owing to their potential applications.[2] The fluorescent moiety attached chemosensors have been extensively used for various applications; first and foremost in environmental restoration, in imaging and in assays.[3] Enormous amount of work has been carried out using fluorophores to develop chemosensor system for the detection of various metal ions and biological components.[4]

Nanoscale materials, for instance, nanoparticles, a size up to 100 nm with increasing surface to volume ratio providing more active surface atoms to improve the properties of the materials and to contribute the role in diverse applications.[5] Among the different metal nanoparticles (MNPs), gold nanoparticles (AuNPs) are excellent scaffolds which are drawing much attention owing to their applications in diverse fields of medicine, catalysis and industrial with respect to their novel optical, electrical, electronic and catalytic properties.[6] Consequently, AuNPs offer good platform with a wide range of organic or biological fluorescent ligands for the selective and sensitive binding and detection of biological targets. Based on the above insights, herein, we report rhodamine6G capped AuNPs with dendritic architecture and its Cr^{3+} ion sensing property through naked eye, live cell imaging, and in real water samples.

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Nanodevices and Nanomaterials for Early Onset Disease Detection and Prevention

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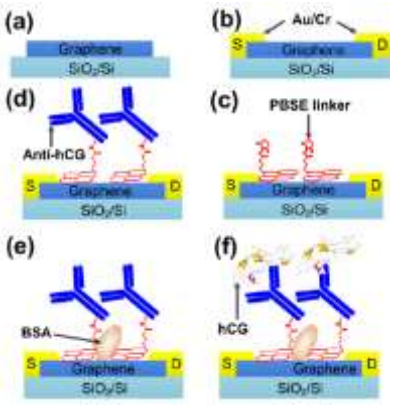
To enhance the quality of life in a world where many countries have an ageing population it is important for us to be able detect key indicators, known as biomarkers, that are uniquely linked to the detection of diseases at the earliest possible time. For some diseases, such as Alzheimer's, Parkinson's and Multiple Sclerosis there is no cure at this moment in time. Detection of these diseases before there are any symptoms present maximises the time available to learn how to manage them. This is important for those directly affected and also to their family and friends who will play a significant role in their overall quality of life. For some diseases, such as brain tumours, detection at an early stage is almost impossible today, and even when symptoms present themselves, detection and confirmation is invasive and mostly too late. Can indicators in body fluids be one way to test at a much earlier stage. Detection at a very early stage can enable many aggressive tumours to be treated successfully, often totally cured. Other diseases can be prevented by detecting the presence of contaminants in water, such as heavy metals and pathogens.

The detection of biomarkers and contaminants needs to be simple, selective, specific and low cost. Detection of these is being explored using nano-sensors based upon electro-chemical responses, or electrically using FETs. Graphene is a useful material for these sensors, but is expensive and difficult to incorporate into devices. However, graphene provides a benchmark to explore other materials. The key material will be reduced graphene oxide (rGO), but other 2D materials will be explored too in the near future.

The specific detection is based around antibodies or aptamers that can uniquely bind with specific biomarkers.



a) The figure to the right shows the preparation of the biosensing mechanism, in this case for a gFET device. Monolayer graphene on SiO2/Si substrate
b) Fabrication of BG-gFET
c) Anchoring of non-covalent linkers by π-π bond
d) Immobilization of antibodies
e) Blocking by BSA
f) Binding of hCG antigen

Femtosecond Laser-induced Control for Quantum Information Processing

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Quantum information and computing are expected to bring about a watershed moment in computing, in spite of the obvious discrepancies between the quantum mechanical and the classical regimes of high-performance computation algorithms. The drive towards miniaturization coupled with the possibility of high infinite information parallelism due to quantum effects outweighs the circuit implementation barriers at quantum length scales. Though quantitatively indistinguishable from a classical Turing machine, Quantum computers do not function along with the same operating principles as their classical counterparts. Indeed, analogies to classical computations are limited by the fact that very few algorithms are able to leverage effects like superposition and entanglement to show 'quantum supremacy'. Some of the most difficult aspects of quantum computations involve the understanding and reinterpretation of classical terms such as computational power, memory, and storage in the quantum domain, and direct analogs fail. One of the more elegant implementations of quantum computing and information relies heavily on optical approaches, at the forefront of which, due scalability and near room temperature operation, our techniques excel. These approaches rely primarily on light-matter interactions, typically at ultrashort timescales. We blend theoretical computational chemistry in the form of molecular system dynamics and their control towards achieving quantum computation in keeping with the DiVincenzo criteria. One of the necessary benchmarks needed in this field is the understanding of the performance of the classical versus quantum approaches and rationalizing the advantage of the quantum simulations, most of which is not possible to achieve on meaningful experimental timescales in-spite of the advances in HPC. Similarly, our experimental nonlinear optics works often involve large molecular systems whose dynamical structures are only possible to be ascertained theoretically. Though not directly realizable, ultrashort times are also strongly correlated to ultra-small sizes. Spatiotemporal control aspects of pulsed laser experiments rely on the ability to modulate the shape of the generated pulses in an efficient manner. Drawing from current state-of-the-art theoretical aspects of computational simulations to reduce the sim-to-real bottlenecks, we devised a novel schematic for the generation of on-the-fly calibrated pulse trains with more accountability than existing techniques under the domain of optimal control theory. We have pioneered several techniques that include femtosecond Fourier domain pulse shaping. These techniques are ubiquitous in developing cross-disciplinary applications ranging from quantum computation to novel biomedical devices. Such techniques further diminish the divide between experiment and theory.

Characterization and Applications of Tunable Graphene Based Composite Films

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Graphene is highly appreciated due to its extraordinary electrical and transport properties. Graphene based composite films find wide range of applications in the field of electronics such as flexible sensors, replacement of resistors, ability to use it as radiating patch antenna. Characterization techniques like Raman analysis, XRD and AFM imaging were also carried out to confirm that graphene based composite films can be used in engineering and biomedical applications. This research work primarily explores the non-destructive strain sensing property of graphene-composite film using Raman analysis and Raman mapping. Secondly, the dielectric natures of different weight percentage of graphene based composite films were measured and the possibilities of using it as alternative to conventional dielectric substrate in micro strip patch antennae were also explored.

Different weight percentages of graphene based composite films prepared using solvent casting technique. All the weight percentage of graphene based composite films were subjected to different strain levels (say 5, 10, 15, 20, 25) of maximum strain limit by attaching the films to (American standard of Testing Material) ASTM specimen using Universal Testing Machine (UTM). Raman analysis of different weight percentage of Graphene-PVDF films were carried out. ID/IG ratio for all the strain level of each film were calculated. Calibration curve representing ID/IG ratio along y-axis and strain values along x-axis will be drawn for different weight percentage of the film. Standardization of strain sensing can be achieved based on the calibration graph obtained. It can be used as a prediction technique to find out unknown strain value by measuring ID/IG ratio using Raman spectrometer. Raman Mapping is also carried out to map the localized strain variation in terms of image pattern. Atomic Force Microscope (AFM) imaging correlate the relationship between strain and roughness of the film for different weight percentage of graphene based composite films. Compare and optimizing the relationship between strain level, resistance of the film, ID/IG ratio, thickness and roughness of the film for different weight percentage of graphene nanocomposite films were carried out.

Broadband Dielectric Spectrometer (BDS) were used to measure the dielectric strength, conductivity and permittivity of graphene based composite films as a function of frequency varying from 1 hz to 10^6 hz.

Finally conventional dielectric materials like Bakelite, FR4 substrate used in patch antennae were replaced with Graphene based composite films and its dielectric value can be altered suitably by varying the weight percentage of graphene in polymer matrix. The radiation pattern and return loss were calculated. Advantage like Tunable dielectric properties of graphene-PVDF films were obtained by varying the content of graphene fillers in the polymer matrix.

Nanostructuring of Graphene for Devices Applications: An Interface Study

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Graphene finds a very important place as a material in various energy applications such as harvesting, storage as well as in sensing. Graphene nanoribbons are promising candidates for generation of waveguides on account of their enhanced and strongly localized plasmonic behavior. Graphene transparent electrodes are important candidates for organic solar cells in place of ITO. Nanostructuring of graphene can be done employing a variety of techniques. In this work, Atomic Force Microscope (AFM)-based nanolithography has been employed to perform the nanostructuring of graphite and graphene under ambient conditions. It was found that the nanometeric trenches created by AFM-based nanolithography undergo significant changes in the dimensions of created nanometric trenches long after lithography. The changes in the morphology of the nanometric trenches created has been studied using intermittent contact AFM under increasing adsorbed water layers. The impact of the interaction and dynamics of increasing ambient water adlayers on etch patterns on a hydrophobic highly oriented pyrolytic graphite (HOPG) surface, few layer graphene (FLG) and multilayer graphene (MLG) were obtained using atomic force microscopy (AFM) voltage nanolithography in contact mode by applying a positive bias to the sample. The effect of the stored electrostatic energy of a polarized ice-like water adlayer, results in changes in the dimensions of the etch patterns long after lithography, whereas liquid like water droplets do not affect the etch patterns.

The role of ice-like water adlayers (IWLs) formed under ambient conditions in between mechanically exfoliated as-prepared and patterned few layer graphene (FLG) and multi-layer graphene (MLG) on hydrophobic Si and hydrophilic SiO_2/Si substrates will be also be presented. The dependence of the formation of IWLs under ambient conditions on the affinity towards water, at the interface of graphene on hydrophobic and hydrophilic substrates isreported will be discussed, which has important implications for the performance of graphene-based nanoelectronic devices.

Electrocatalysts Applied Toward Oxygen and Hydrogen Evolution Reactions and Oxygen Reduction Reaction

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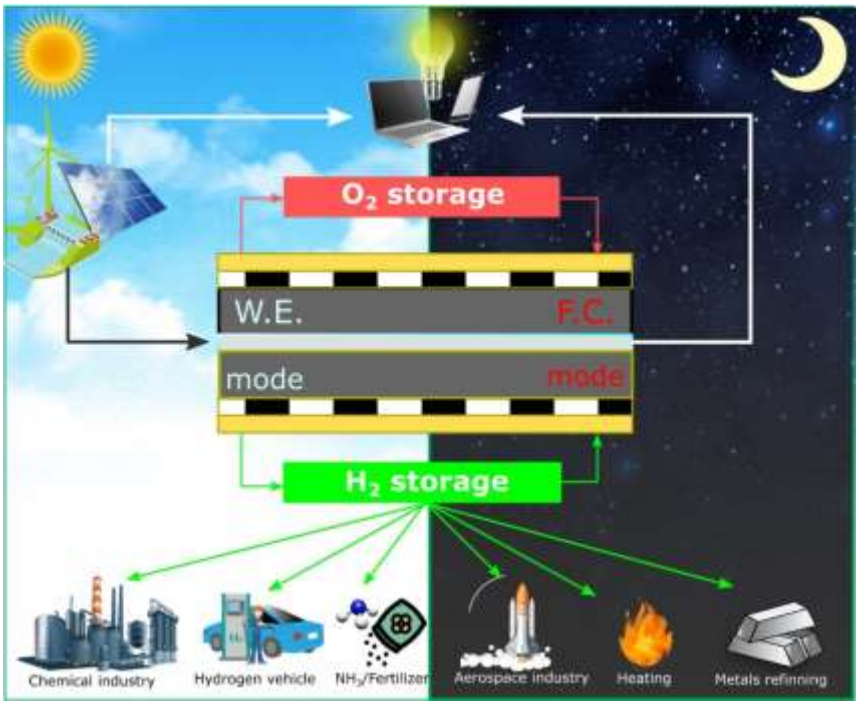
The development of renewable and clean energy storage and conversion devices is the main goal to face the continuous increase at energy consumption around the world and to decrease the environmental degradation. At the heart of these energy conversion/storage devices, such as fuel cells, metal-air batteries, and the 'breakdown' of water itself, are very important electrochemical reactions such as the oxygen reduction reaction (ORR), and oxygen and hydrogen evolution reactions (OER and HER), which generate electricity or hydrogen as a fuel. As these reactions are naturally slow, it is necessary to use electrocatalysts to facilitate them. Electrocatalysts are therefore one of the critical factors determining the efficiency and cost of these energy conversion and storage devices. The latest generation electrocatalysts are based on noble metals (e.g. Pt) or their compounds. However, the scarcity and high price of these noble metals make it difficult to apply them globally to these devices. Therefore, it is necessary to develop noble metal free electrocatalysts or at least using few amounts of noble metals or yet only involving abundant and inexpensive metals that have high efficiency, low cost, and long durability.



Advanced in Nanomedicine: Synthesis or Biomimicry?

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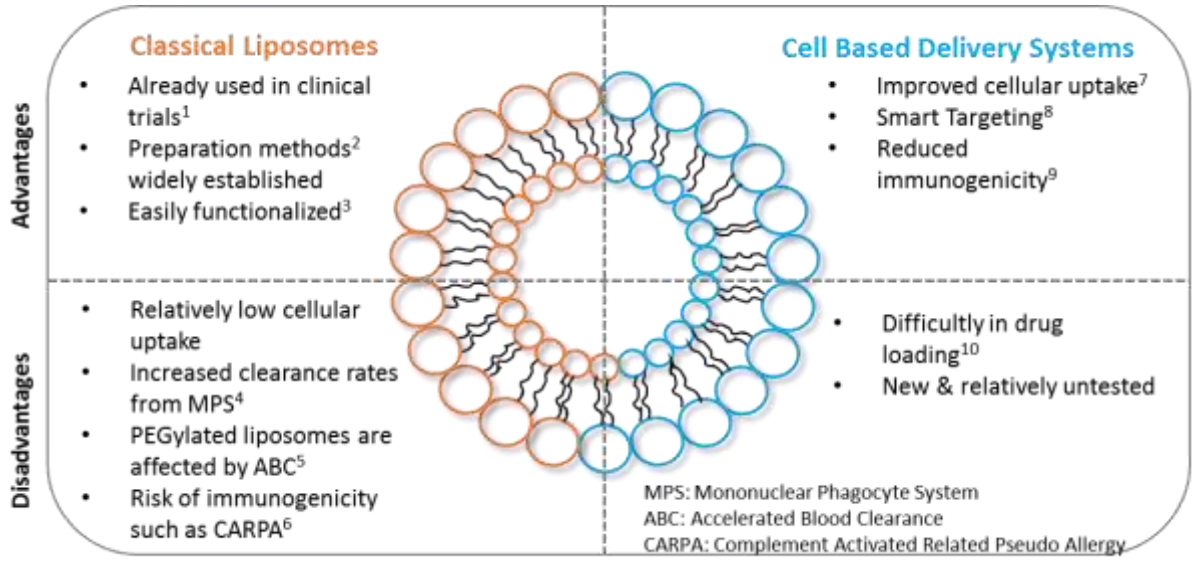
Efficient methods of drug delivery are of paramount importance in the successful treatment of medical conditions. Problems associated with drug's limited solubility, tissues damage etc., can be overcome and/or ameliorated by the use of a drug delivery system (DDS). Current DDS mainly include synthetic nanoparticles like liposomes, dendrimers, polymeric & metal nanoparticles. Several efforts on these materials have resulted in approximately 250 nanomedicines currently approved or in various stages of (pre)clinical evaluation.

However, major drawbacks of these nanoparticles include weak specific tissue targeting properties and non-optimal local drug delivery, limiting the therapeutic outcomes. Hence, recent advancements have explored the use of biomimicry-based DDS, ranging from exosome mimetics to cell-derived nanovesicles and even nano-cell ghosts: this generation of DDS is designed to exploit our body's own cells to generate novel DDS that provide the benefits of intrinsic targeting towards cancer cells (due to the preservation of surface cues on from their original parent cells) and nano-size dimensions (which enable the accumulation at the diseased area), thus paving the way towards new advances in the field of personalized nanomedicine.



Graphene-Based Nanomaterials for Electrical Energy Storage Applications

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Demand for electrical energy storage is increasing every year due to increase of human populations and electric and electronic products that consume ever more energy. These products either require portable electricity or grid based electricity. The world is facing critical situation with high level of CO_2 emission due to excessive use of conventional energy in the form of fossil fuels. Renewable energy such as solar energy and wind energy has been the major energy supplement replacing the conventional energy for the past decades. However, these energies are intermittent in nature and thus require an energy storage solution. The most reliable devices for the energy storage are supercapacitors and rechargeable batteries. In this presentation, various types of graphene will be used as active ingredient for supercapacitor, and Aluminium-ion batteries (AIB). Various methods have been introduced to produce various type of graphene includes graphene oxide, graphene nanoplatelets and their composites. The energy storage mechanism using these graphenes were studied and the performance of energy storage correlated to the active materials used were investigated.
Keywords: Supercapacitor, Aluminum ion Batteries, Graphene.

Theranostic Polymeric Nanogels for Biomedical Applications

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Multifunctional nanocarrier which has both therapeutic and diagnostic capability (theranostic) is a emerging novel component in nanomedicine. Diagnosing tumors and targeted drug delivery are important for the treatment and long-term management of cancer. Therefore, development of polymer based nanoformulations as theranostic agents are highly relevant for cancer therapy. Polymer based near IR emitting fluorophores in nano scale are more preferred for diagnosis and imaging modalities, since near IR emissions have the highest tissue penetration with lowest autofluorescence. Near IR emitting fluorophores such as quantum dots, organic dyes and lanthanides are associated with drawbacks such as toxicity, non-biodegradability and short circulation half-life *in vivo.* The use of polymeric hydrogels in nanoscale as theranostic carrier has several advantages such as high water absorptivity, rapid response to external stimuli, high biocompatibility and availability of versatile functional groups for conjugation with imaging and therapeutic agent. Hence the development of biocompatible and self fluorescent polymeric nano hydrogels with near-IR imaging potential and targeted drug delivery is explored. Novel nano hydrogels based on multi-modal biodegradable photoluminescent comacromers, poly (propylene fumarate)-PEG- citric acid-glycine (C-PLM) and octreotide conjugated comacromer, PEG-maleic acid-4 aminobenzoic acid (PMB), diethylene glycol dimethacrylate (DEGDMA) and octreotide are investigated as candidate material for theranostic applications. These candidate nano hydrogels exhibit excitation-dependent fluorescence (EDF) at near IR region and deliver doxorubicin cancer drug in Hela cells. Near IR imaging and longer *in vivo* circulation lifetime (biodistribution) are interesting observation noted in mice. These candidate nano hydrogels are promising theranotisc agent for cancer imaging and treatment.

Self-Powering Fabrics: An Approach to Power Your Phone from Your Coat

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Presently, wearable electronic devices are used for communication, on-body sensing, artificial skins, health monitoring systems, and entertainment devices. It is highly beneficial if wearable electronic devices can be integrated into clothes, eyeglasses, and watches, or implanted directly into the body. For example, if wearable health monitoring systems are directly attached and remotely monitored, it can reduce/eliminate the hospital stay for patients. Since all wearable electronic devices require energy to operate, flexible and wearable energy devices are an integral part of these devices. This presentation focuses on our recent advances in the direction of energy devices in the form of wearable energy fabrics. In our group, the research in this direction was initiated by fabricating filaments in the form of copper ribbons or carbon fibers that are thin, flexible, and lightweight. These ribbons were weaved along with cotton filaments into a piece of fabric. Both energy harvesting and storage were accomplished in these filaments by integrating a solar cell on one side and energy-storing device on the other. When these smart energy filaments were exposed to sunlight, energy is harvested by the solar cell and directly transmitted to the storage unit avoiding the requirement of a separate battery. These fabrics would essentially turn a jacket into a self-powered energy source from where wearable devices can be charged. This can be highly beneficial for firefighters, soldiers, and first responders who carry heavy loads of batteries for their missions or social media addicts who could charge their smartphone by simply slipping it into their pocket. There is a host of other potential uses, including electric cars that could generate and store energy whenever they're in the sun.

Magnetic Nanofluid Based Senors

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The quest new structural and multifunctional materials stems from the manufacturing cost reduction, superior performance, power saving and miniaturization. Among various new materials, nanomaterials have been at the forefront because of their superior properties and interesting technological applications in diverse fields. Nanomaterials are proved to be ideal for biomedical applications such as cancer therapy, tissue engineering, molecular imaging and biosensors, owing to the right size to interact with bio entities.

The magnetic nanomaterials dispersed in carrier fluids exhibit interesting physiochemical and optical properties under a magnetic stimulus. Besides they are wonderful model system to probe and understand some fundamental phenomena such as phase behavior, order-disorder transition, self-assembly, molecular interactions, polymer conformational changes etc. Owing to the field enabled physical property changes of magnetic fluids, they come under the category of smart materials.

Over the last two decades, we have been working on synthesis, characterization and development of newer application for magnetic fluids. We have developed practical applications for magnetic fluids in optical devices, cation sensors (switches, filters etc), defect detecting sensors, smart cooling devices, dynamic sealing, bio medicine and cancer therapy.

Nanostructured Metal Oxide Composite Materials for Infrared Reflective Energy Efficient Cool Coatings

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There is a global opportunity to develop a new generation of infrared reflective materials that utilise nanostructures to meet the rapidly expanding demand for infrared reflective "cool coatings". As energy costs increases, the global demand for energy efficient cool coatings will also increase. Increasing the solar reflectance of a surface will have a positive impact on durability and reducing thermal cycling stress and coating temperature. It will reduce delamination or peeling of the surface coating. Over the last few years we have successfully synthesized pure and doped metal oxide (TiO_2, CuO) composite materials by the arc discharge method [1-3] without catalyst and developed understanding of the processing conditions in relation to the crystallite size and optical properties, such that we are now able to develop commercially viable paint formulations for industrial uptake. The infrared reflectivity of anatase TiO_2 nanopowders increased from 76 – 90% by increasing the crystallite size from 3 – 27 nm. The highest TSR (total solar reflectance) obtained was 87.6% for a TiO_2 concentration of 25% in a paint medium. The near infrared reflectance of copper oxide composite was increased by increasing the specific surface area and concurrently reducing the Cu content of the composite material. Low reflectance in the visible region combined with high reflectance in the near infrared region make these materials a suitable candidate for solar radiative filters which will demonstrate black appearance but keep cool under solar irradiation. Detailed results will be discussed in the presentation.

Keywords: Energy materials, metal oxide, Energy recovery, Semiconductors.

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Materials Engineering for Spin-valley Qubits

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Quantum computing with few to tens of qubits can now be performed on several technology platforms, and the assertion of quantum supremacy appears imminent based on recent reports. Nevertheless, the task of scaling up to a universal quantum computer to handle real world problems (deemed intractable for classical computers) remains a distant reality. Amongst other priorities, increasing the number of qubits whilst maintaining a manageable error rate is paramount. The engineering challenge for building a full-fledge quantum computer is the reliable scale-up of the number of qubits. This a multidisciplinary problem requiring scientific and engineering breakthroughs in materials, processes, multi-qubit architectures, quantum measurement techniques in the least. In this talk, I will introduce our recent efforts to establish the capabilities for building spin-valley qubits based on layered 2D semiconductors. The unique spin-valley coupling in such materials is expected to suppress decoherence since a spin flip requires the concomitant change of valley. In addition, their compatibility with electrostatically-gated planar qubit architectures are desirable for reducing system complexity and hence scalability. I shall present some of our recent results in materials engineering and initial device results toward this goal.

Smart Autonomous Sensor System for Vital Signs Monitoring

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Cardiovascular diseases (CVD) remain the leading cause of mortality and a major cause of morbidity in the world. 17.7 million people die every year from cardiovascular disease, that's 31% of all global deaths. These are alarming statistics and in most cases the cause is of ventricular arrhythmias, including ventricular tachycardia (VT) or ventricular fibrillation (VF). Ventricular arrhythmia is an abnormal electrocardiograph (ECG) rhythm and is responsible for 75%–85% of sudden deaths in persons with heart problems unless treated within seconds. Most arrhythmias are caused by coronary heart disease, hypertension, or cardiomyopathy, and if not accurately diagnosed nor treated, immediate death occurs. The implantable cardioverter-defibrillator has been considered as the best protection against sudden death from ventricular arrhythmias in high-risk individuals. However, most sudden deaths occur in individuals who do not have high-risk profiles. Long-term ECG monitoring is the criterion standard for the diagnosis of ventricular arrhythmia.

Over the last decade, many wearable ECG systems have been proposed and are even available in the market. However, such sensors are bulky and suffer from inaccuracies, large power consumption and short battery lifetime. Moreover, majority of them are based only on ECG monitoring whereas multi-sensor functionality is desirable to holistically monitor several vital signals that can be essential for meaningful home health care, sport activity and remote patient-doctor communication.

There is a tremendous necessity of developing a personalized smart multi-modal vital signs monitoring device that is seamlessly integrated to skin with multi-fold increased sensor accuracy and powered by battery backup and with a very low form factor. To address the aforementioned problems, we propose for the first time an electronic smart system[1] with multiple sensors to monitor ECG, respiratory flow, oxygen flow, blood pressure and temperature and chemical sensors to monitor cortisol, pH and glucose from sweat[2-4]. To ensure autonomy of the smart system, we are customizing the design with low complexity analog front-end circuit which will be powered by body heat energy conversion strategy through high efficiency thermoelectric generator[5] to prolong the life of novel thin film battery. This is a first worldwide attempt to provide a flexible multi-modal ultra-low power bio-signal monitoring device.

Promising New Strategies in Multifunctional Materials Designing for Nanotheronastic Applications

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Nanotheronastics is a remarkably promising fast growing area in nanomedicine. At the advent of novel synthesis strategies of nanomaterials with substantially reduced levels of toxicity and much improved biocompatibility, the explorations of novel combinations of synergistically active components for biomedical applications are on a noticeably high surge. The talk would highlight some recent developments of this area with special focus on cancer therapy. For instance, the enhanced biocompatibility of nanosized contrast agents with high radiodensity and specific biodistribution is an important parameter for localized tumor imaging and organ safety. Various combinations of nanoparticles such as metal nanoparticles including gold, platinum and porous material such as mesoporous silica in combinations with biomolecules viz., lipids and biopolymers are recently gaining major attention due to their judicious design strategies for improved bio applications. The applications include biomedical imaging options with high radio densities, precise targeted and triggered drug delivery with improved intracellular updates and reduced premature release with nanogating technologies and effective combinations of alternate therapy opportunities. The talk targets to give short review of these developments along with few recent examples of our contributions.

Some of our recent demonstrations of novel concepts including the ones with combinations of highly surface resonance active gold nanorods that are encapsulated in the core of nanoscopic mesoporous silica including active site specific ligand binding options with agents such as folate receptors will be presented. This will be supported with some more examples including liposome - gold nanorod based nanocomposites, liposome - graphene nanocomposites with various interesting demonstrations. In-vitro studies for breast cancer cells such as 4T1 and MDA-MB-231 including their interesting observations on breast tumor diagnosis, organ safety, and excretion using a one-time dose administration along with some in-vivo studies viz., tumor diagnosis and specific biodistribution will be shown as some interesting case studies. The talk with effective examples of is envisaged to provide a quick yet effective review on the state of this art and its future scope.

Vertical Graphene Nanowalls for Energy Storage Applications

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The Vertical Graphene Nanosheets or nanowalls (VGNs) are three dimensional, interconnected porous network of vertically standing nanosheets each made up of a few graphene layers. These features make them a potential candidate for supercapacitor electrodes. VGNs is a relatively new entrant to carbon nanostructures family. Its remarkable properties such as high surface area, electrical conductivity, chemical inertness, ease of functionalization and mechanical stability have attracted a lot of research interest towards their potential applications like energy storage, sensing, nanomembranes etc., Using the most favoured Plasma Assisted Chemical Vapour Deposition (PACVD) technique, VGNs of few micron height uniformly over a large area could be grown on different substrates and their Electrochemical behaviour were studied. This talk will address the growth, growth model, a ternary field map that directs the desired growth, a simple oxygen plasma treatment to transfer the inherent super hydrophobic nature of VGNs to super hydrophilic and their by achieving a ten fold increase in their charge storage capacity. A simple and easily scalable method for transferring VGN films onto flexible polymer substrates to overcome the impediment of high growth temperatures and the performance of a device made using these flexible electrodes will also be discussed.

Photocatalyst by the Use of Organic Semiconductors

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The present photocatalyst is full organic system without any metals (ions), and responses to full spectrum of visible light, sometimes reaching to near infrared. A film style photocatalyst performs macroscopic site separation of redox as both sides of polymer film. It is possible to construct a high through put reactor with layering of the polymer film photocatalyst. Furthermore, a high through put synthesis of the photocatalyst as water suspension has already commercialised by the use of a microfluid device.

Keywords: visible light photocatalyst, organic semiconductors, film photocatalyst, high throughput reactor, mass productive.

Ferro- and Antiferro-Magnetic Competition in Thermally Oxidized Ni/Nio Nanopowder and Granular Thin Films

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Ni/NiO nanopowder and granular thin films were thermally oxidized by annealing at different temperatures from 300 to 1000ºC and their magnetic properties were studied by DC-MPMS- SQUID magnetometry. The oxidation increases with annealing temperature. The magnetic measurements show coexisting ferromagnetism and antiferromagnetism, corresponding to Ni and NiO contributions. In general, the magnetization decreases with annealing temperature because the consumption of Ni to form NiO. The hysteresis loops for the samples annealed at 250 and 300℃ shows exchange bias up to 200 Oe only at 5 K. We believe that this is caused by the presence of a surface anisotropy which is enhanced at low temperatures and increases the number ferro/antiferro spin interactions. The tendency of the coercivity at low temperatures for the sample annealed at 300℃ seems to have low values when comparing to those for the samples obtained after annealing at other temperatures. Apparently, some spins located on the anisotropy layer and/or grain boundaries align easily at any applied magnetic field inducing the sample to be soft magnetic. This volative magnetic anisotropy layer disappears at higher temperatures than 100 K.

Design and Fabrication of Supercapacitor as Next Generation Energy Storage and Conversion Device

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The rapid growth in the advancements on the development of portable electronic systems has stimulated the research interest among the researchers to design and develop the innovative electrical energy storage devices with maximum energy density and power density. The design and developments of effective and economic devices to store electrical energy for use on demand are critical issues. In this regard, lithium-ion batteries (LIBs), supercapacitors (SCs) and lithium-ion capacitors (LICs) are considered as effective electrical energy storage devices those are extensively utilized not only for powering several portable electronic devices but also for hybrid electric vehicles. Supercapacitors have been considered as a promising next generation energy storage device owing to their ultra-fast charging, very high power density, long cycle life and maintenance free as compared with most widely used LIBs in the commercial applications. At the same time, low energy density and high fabrication cost of supercapacitors as compared with LIBs are restricted their practical applications and hence supercapacitors are not the energy storage technology of choice for many commercial applications**.** Although the energy density of SCs is lower than LIBs, the commercial supercapacitors with currently available energy density have been widely accepted and the potential users find SCs for various applications such as emergency doors opening, energy recovery, flash/solar lights, memory backup, regenerative braking and transport sectors (Buses, tramways, hybrid cars) etc. The increasing energy density and lowering the manufacturing cost are the primary challenges facing SCs developers and these should be achieved without sacrificing the high durability and exceptional high rate performance that sets SCs apart from batteries. The opportunities and current challenges in the design and development of supercapacitor device for real world applications will be discussed and highlighted.

Nanostructured Materials for Lithium Sulfur Batteries

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The development of alternative transportation, such as fully electric or hybrid vehicles, has become a key need for a sustainable long-term solution of climate change and non-renewable resources. Lithium batteries with high energy and long life have been the core power source technology for new energy vehicles. Although the state-of-the-art lithium-ion batteries have become prominent to portable electronic devices such as lap-top computers, mobile phone etc., there is a consistent demand for improvements in the cost, energy, power and safety issues. Owing to its appealing properties such as high theoretical energy density, capacity, low cost and better safety, lithium sulphur battery has been identified as an alternative system to Lithium –ion batteries.

However, the poor conductivity of elemental sulphur, formation and subsequent shuttling of polysulfides and poor interfacial properties of lithium metal anode with non-aqueous liquid electrolyte hamper it from commercialization. Numerous attempts have been made to enhance the electronic conductivity of sulphur by wrapping or confining in carbonaceous materials. The undesirable migration of polysulfides not only affects the Coloumbic efficiency but also the calendar life of lithium sulphur batteries. However, reports on the suppression of polysulfide migration between the electrodes are very scanty.

In our laboratory, we have prepared novel nanostructured materials such as carbonaceous, metal organic frameworks, metal oxides etc., and were employed as electrode and permselective materials in separators for lithium –sulfur batteries in order to confine the migration of polysulfides between the electrodes. The influence of nanostructured materials on the electrochemical performance of lithium-sulfur batteries will be discussed.

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Life Cycle Thinking: Towards Sustainable Nanotechnology

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The presence of high concentration of heavy metals and dyes in natural water supplies and industrial wastewater streams is a critical health and environmental issues due to their persistence, high toxicity and bioaccumulation through the food chain and hence in the human body. Technologies based on the utilization of magnetite nanoparticles for the removal of these toxic pollutants from wastewaters are under active development as highly effective, efficient and economically viable nanoadsorbents. Although there is much recent interest in the use of engineered magnetite nanoparticles in wastewater treatment, however, uncertainties over the health and environmental fate of the nanocomposite adsorbent need to be addressed prior to their widespread application. Therefore, the environmental performance of the scale-up magnetite nanoparticle adsorbent must be assessed and benchmarked using an integrated LCA-based method. The outputs of the excellent adsorption performance of the magnetite nanocomposite, along with its low cost and convenient synthesis, makes this adsorbent highly promising for commercial applications in drinking water purification and wastewater treatment. Thus, exploring the potential use of local bio-waste in treating wastewater needs to be extended by incorporating the environmental sustainability performance assessment of the scale up fabricated magnetite nanocomposite adsorbent. Feasibility analysis and holistic sustainability performances of the nanocomposite adsorbent need to be designed to support the waste management initiatives towards circular economy as an alternative to traditional linear economy.

Strategies for Enhancing Efficiency of Hybrid Perovskites and Bulk Heterojunction Solar Cells

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The increasing energy demand and scarcity of conventional non-renewable resources, has turned to be a bottleneck for survival present and future generations. Undoubtedly the clean, inexhaustible, economically viable solar energy, can be an immediate need of the hour and a permanent alternative solution to meet the terawatt level energy demands. Various approaches and strategies are researched in the recent years for enhancing the performances of the devices Therefore the current talk will address the most preliminary issues during fabrication of efficient configurations of solar cells. Perovskites and bulk heterojunction devices are affordable for efficient clean energy production and also a cheaper alternative that is captivating the global scenario. Hence, a focus is laid on non-conventional perovskite single crystal based solar cells and address the challenges imposed during the integration into the devices. In the BHJ devices, engineering the energy landscape, by choosing the suitable electron and hole transporting layers are paramount for highly efficient devices that would lead to viable commercialization of the flexible solar cells.

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Nanostructured Materials for Catalytic and Biomedical Applications

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Metallic and organometallic catalysts are used in various organic transformations. While homogeneous organometallic catalysts are often used, the difficulty in separation and recycling of the catalyst as well as huge waste generation hinders industrial applications. Hence, the search for more efficient catalytic systems with greener aspects that might combine the advantages of both homogeneous and heterogeneous catalysts is one of the most exciting challenges of modern chemistry. Simple methods of making highly active, recyclable and heterogeneous nanostructured catalysts and their applications in various organic reactions will be presented. The catalysts were recyclable with a simple filtration, and reused several times without significant loss in activity and selectivity. Nanostructured materials have been developed for various medical and biological applications. Clinical applications of human stem cells require large cell numbers and cell growth under chemically defined conditions. We are developing cost-effective and fully synthetic coatings that can be applied to flat synthetic substrates and microcarriers. Largescale expansion of human embryonic stem cells, induced pluripotent stem cells and mesenchymal stem cells on these substrates is addressed by using serum- and xeno-free media. The success of implantable biomedical device technologies crucially depends on controlling bio-interfacial phenomena, such as foreign body response and implant encapsulation. Thus, precise control of interactions between host material surfaces and the physiological environment is critical for effective and safe application of medical devices and biosensors. Novel nanostructured hydrogel materials of various compositions, architecture and surface chemistry are created with excellent anti-fouling performance and long-term durability under in vivo conditions. The talk will include synthesis and characterization of various nanomaterials with chemical and structural versatility, and the full potential of these materials for catalytic and biomedical applications.

Enhanced Performance of Vanadium Nitride Xerogel as an Efficient Counter Electrode for Dye-Sensitized Solar Cells

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A unique, new structure of vanadium nitride xerogel were formed by ammonialising hydrothermally prepared V_2O_5 xerogel at higher temperature. This novel material has been well characterized for its structural and morphological studies and tested its electrocatalytic performance as a choice of counter electrode for Dye sensitized solar cells (DSSCs). The phase and crystallinity of the material was confirmed with X-ray diffraction analysis, the morphology of sample was analysed using field emission scanning electron microscopy and transmission electron microscopy with EDAX. The electrochemical properties such as electrocatalytic activity and charge transfer resistance of this new form of vanadium nitride was studied using cyclic voltammetry, electrochemical impedance spectroscopy, and tafel polarization. The photo-current studies were performed under standard 1SUN class AAA simulated illumination with AM1.5G. The consolidated results revealed that, this new structure of vanadium nitride xerogel exhibited good photocatalytic activity and low charge transfer which identified it as a promising counter electrode material for dye sensitized solar cells. The photo-current conversion efficiency of the vanadium nitride xerogel CE based DSSC pull off 6.94% which showed enhanced performance compared to thermally decomposed Pt CE based DSSC 7.38% with same iodide/triiodide electrolyte system.

Applications of Neutron Scattering Measurements to Biopharmaceutical Formulations

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Biophamaceuticals comprise over 100 billion USD in global sales and have revolutionized human health care. Neutron scattering measurements are uniquely positioned to answer some key questions in the biopharmaceutical industry as they cover length scales from the nanoscale to the microscale as well as pico-to-100 nanoseconds dynamics. I will discuss the use of neutron techniques to aid in the development of biopharmaceuticals by providing examples from our work on the use of neutron measurements to solve fundamental questions concerning monoclonal antibodies and their formulations. This includes studies of excipients as well as mAbs in solution and at interfaces. Examples include recent studies using neutron spin echo to determine the dynamics of the NIST standard mAb, as well as industrial mAbs, in solution.

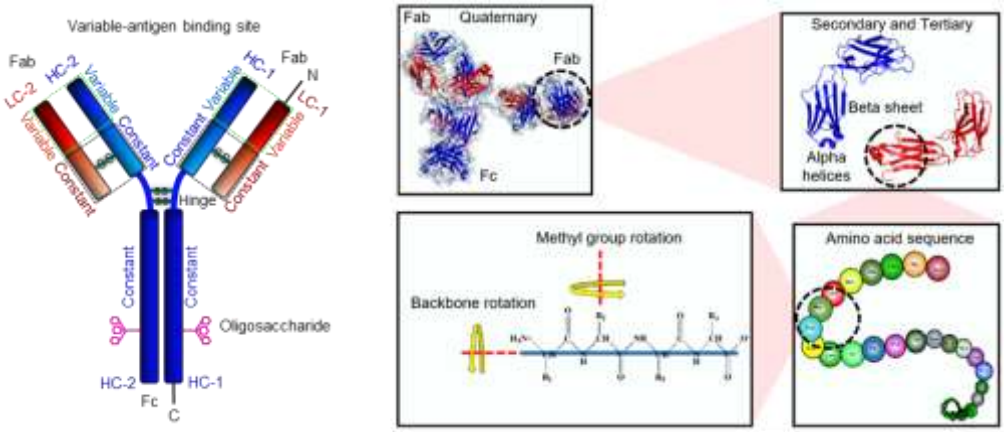

Fig. A) Artistic rendition of the quaternary structure of NISTmAb (IgG1) with two Fabs and one Fc linked via di-sulfide hinges. B) Ribbon quaternary NISTmAb structure with van der Waals surface, tertiary beta sheets and secondary alpha helices formed due to interactions between polar, nonpolar and neutral amino acid groups, and primary structure contains chemical groups (*e.g.*, methyl groups) that can rotate and fluctuate. NISTmAb structure figures are based on the NISTmAb composite model PDB and created with PyMOL version 2.3.0.

Covalent and Noncovalent Functionalised Graphene Flakes for Electrochemical Sensor Applications

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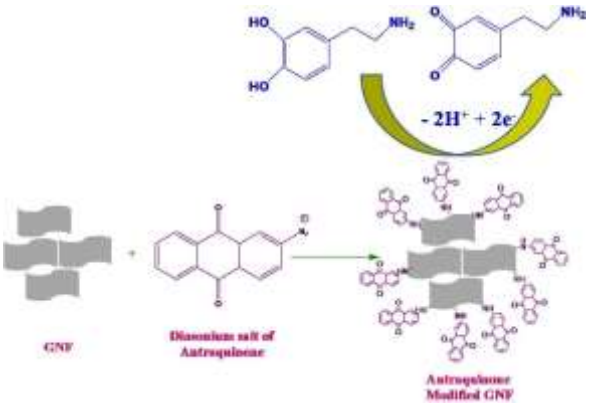
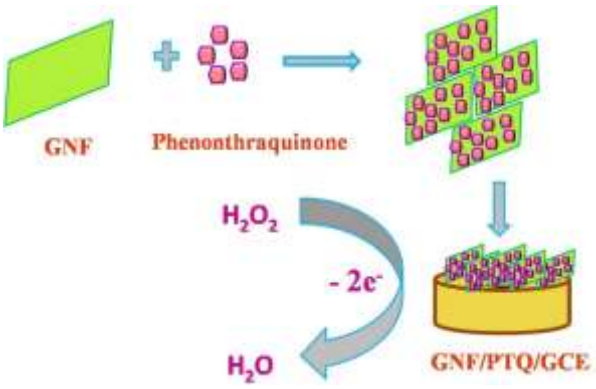
Recently many studies reveal that graphene flakes showing excellent electrochemical response than the graphene sheet because of various reasons. It is understood that the synthesis of graphene sheet involves various stages of preparation procedures including chemical oxidation exfoliation of graphite using strong acids and controlled reduction oxidised graphene yields graphene oxide. To avoid this cumbersome operating procedure, a few layer graphene flakes can be synthesised by simple solvent exfoliation or surfactant assisted sonochemical exfoliation and also convenient to use for various electrochemical sensor applications. By this method it is easy to synthesis a few layer graphene sheet in large scale with high surface area without any defects. In order to improve the electrocatalytic behaviour of graphene the surface can be turned further by incorporating various redox active molecules as an electron transfer mediator. The surface modification of graphene sheet can be achieved either covalent or noncovalent methods. The noncovalent functionalisation of graphene sheet can be achieved by pi-pi interaction of planer aromatic molecules like pyrene, phenonthraquinone, polymer electrolytes with graphene flakes. On the other hand the covalent functionalisation of redox active molecules can be obtained by diazonium salt of ferrocene, anthraquinone, thionine, and so on mediated reduction radical cations at graphene sheet or by covalent bonding defect edge carboxylated graphene sheet with amine and carboxylic acid terminal redox active molecules. These redox active molecules modified graphene flakes can be used for the electrochemical detection of some of the biological molecules and toxic pollutants.



Scheme 1: Surface modification graphene nanoflake using diazonium salt of antraquinone and its application on electrochemical oxidation of dopamine.



Scheme 2: Surface modified of graphene nanoflakes using 4,10- phenantraquinone and its application of electrochemical reduction of H_2O_2

Photochemical and Photoelectrochemical Water Splitting – The Untamed Dream

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Photochemical and photoelectrochemical water splitting using sunlight is a promising technology capable of providing high energy yield without pollutant byproducts. In photoelectrochemical (PEC) water splitting, hydrogen is produced from water using sunlight and specialized semiconductors called photoelectrochemical materials, which use light energy to directly dissociate water molecules into hydrogen and oxygen. This is a long-term technology pathway, with the potential for low or no greenhouse gas emissions. This lecture explains about various aspects of this technology including chemical reactions, physiochemical conditions and photocatalyst types such as metal oxides, sulfides, nitrides, nanocomposites, and doped materials. It also explains the challenges in tuning the functional properties of the materials such as the band gap, overpotential for hydrogen evolution, and recombination of produced electron-hole pairs. Various approaches will be addressed to tune these properties, such as doping with different elements, heterojunction catalysts, noble metal deposition, and surface modification.

Nanomaterials in Biocatalyst - Electrode Interface for Harvesting Power in Biofuel Cells and Sensor Applications

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There has been a continuous strive to efficiently channelize the electrons from the metabolic center of the biological cells (mainly, bacteria and lower eukaryotes) and the redox center of enzymes during biocatalytic reactions to the conductive electrodes. These efforts have enormous importance in developing biofuel cells and amperometric biosensors to generate more power and better amperometric signals, respectively. The major impediment in channelizing the electrons from these biological sources is their non-conductive thick cell wall (in micron size) and protein matrix (hydrodynamic diameter of enzyme protein > 50A^{o}) that restrict the hopping of electrons to the surrounding environment. There are only a few enzymes whose redox centers are located in the periphery of the protein matrix for free electrical communication with the conductive electrodes. With the intervention of highly conductive nanomaterial, it has been possible to establish the direct electrical communication between the redox center of the enzymes or the metabolic center of the intact cells and the electrodes, facilitating the flow of electrons in the respective devices to generate high power and sensitive amperometric signal. The research in my lab focuses on marine cyanobacteria and a large multimeric redox enzyme, alcohol oxidase (AOx) as biocatalysts to develop biofuel cells to use these developed devices mainly for alcohol biosensing applications. We developed a novel nano-biocomposite matrix by strategically incorporating CdTe quantum dots (QD) and graphene nanoplatelets (GNP) in the silk fibroin (SF) film, which has been previously established as biofilm inducing biomaterial (Kaushik et al. 2016). This nanocomposite matrix was employed over the graphite electrode to develop the anode for a dual-chambered biofuel cell (BFC) with an abiotic cathode (Fig. 1). The matrix-supported biofilm growth of the photo-catalyst *Synechococcus* sp., surged the bacterial photosystems (PS I and PS II) with appropriate light (λ650–750 nm) at a broad excitation spectrum (λ350–644 nm) through FRET and facilitated the metabolic electron relay through direct electron transfer (DET) to the anode (Kaushik et al. 2017). The maximum current density of the BFC obtained was ~5.7 fold higher than that of the control experiment. We demonstrated that the nano-biocomposite matrix with suitable optoelectronic property improved light to current conversion efficiency (4.01 %) in cyanobacteria based BFC set up. We also established multiwall carbon nanotubes as efficient nanomaterials for DET between AOx and electrode, and the proof-of-concept has been utilized to develop a BFC with a power density of 46 μWcm^{-2}.

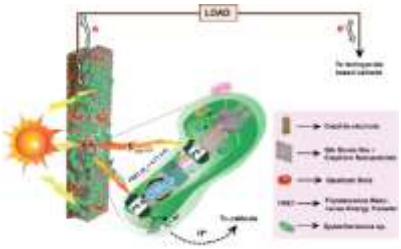

Fig 1. Schematic of the rationally designed nanocomposite matrix comprising of CdTe quantum dots, graphene nanoplatelets and silk-fibroin on graphite electrode developed for a dual chambered PMFC with *Synechococcus* sp. as the anodic photo-catalyst.

Innovative Organic Semiconductors for Transistors, Sensing and Light Harvesting Devices

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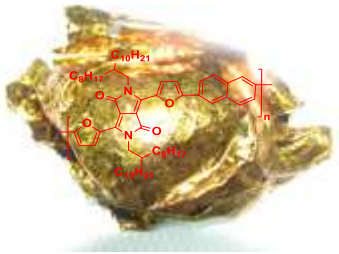
Organic semiconductors are the focus of intense academic and industrial research because they are important functional materials for low cost printable electronic devices, particularly for transistors, sensors and light harvesting devices. The active organic semiconducting materials are emerging due to their ink formulation capability, tunable light absorption/emission, interesting charge transport properties and relatively adequate HOMO-LUMO energies. Photophysical, electrochemical, morphological and electrical properties of these semiconductors are primarily controlled via molecular engineering by selecting suitable conjugated blocks which can be either electron donating (donors) or electron accepting (acceptors). Conjugated π-functional semi-conductors constructed using fused aromatic building blocks is a suitable choice for high performance organic electronics devices.



Porous $CoFe_2O_4$–Reduced Graphene Oxide Composites with Alginate Binders for Li-Ion Battery Applications

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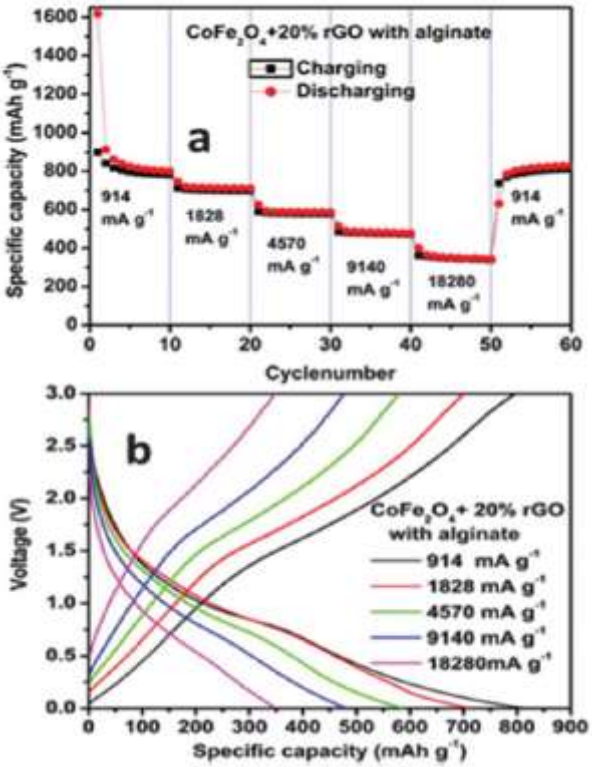
Secondary lithium-ion batteries have been rapidly investigated for new generation consumer electronic devices and electric vehicles. To achieve high energy and power, metal oxides are used as anode materials for the lithium-ion batteries. Cobalt ferrite ($CoFe_2O_4$) possesses a high theoretical capacity of 914 mA h g^{-1}, but it suffers from a severe drawback of high capacity fading during the cycling. It is known that during the conversion reaction electrode pulverization induced huge volume changes during the charge–discharge processes, leading to poor cycling stability. To overcome these problems, researchers have made nanocomposites with carbonaceous material (such as carbon and graphene) and prepared the metal oxides in different morphologies.Porous $CoFe_2O_4$ nanoclusters with different concentrations of graphene based composites were synthesized by a simple solvothermal process. The electrochemical properties of prepared $CoFe_2O_4$–reduced graphene oxide (rGO) composites were evaluated using polyvinylidene fluoride and Na-alginate as binder materials. The $CoFe_2O_4$ + 20% rGO composite with alginate exhibited a high stable capacity of 1040 mA h g^{-1} at 0.1 C (91 mA g^{-1}) rate with excellent rate capability. The observed enhancement in electrochemical properties of the $CoFe_2O_4$ + 20% rGO composite with alginate is due to the high stability and good transportation network while charging–discharging.



Rapid Synthesis and Characterization of Metal Nanoparticle from Collagen

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The current research deals with the rapid synthesize of silver nanoparticles (AgNP) from collagen isolated from Fish skin. The silver nanoparticles were synthesized by using silver nitrate as a reducing and capping agent along with sodium borohydride ($NaBH_4$). Thus, this study is aimed to synthesize silver nanoparticles from collagen that achieved through the modification of the protocol by the addition of $NaBH_4$. The results of UV-Vis Spectroscopy confirmed the formation of silver nanoparticles by showing a sharp absorption peak at 408nm. FTIR spectral peak shows the presence of alkynes, carboxylic acids and anhydrides compounds which binds with Ag and undergo reduction that capped on Ag ions for the conversion of Ag^+ into AgNPs. The XRD structure of AgNPs shows the face centered cubic (FCC) structure and crystalline nature of metallic silver. The morphology of the AgNPs revealed the size of 35-50 nm size nanoparticle under Scanning Electron Microscopy (SEM).

One-Pot Synthesis of Electrocatalysts for Fuel Cell Application

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Electrocatalytic materials for oxygen reduction reaction, currently dominated by platinum/carbon catalyst is marred by drawbacks such as use of copious amount of Pt and use of "non-green" sacrificial reducing agent (SRA) during its synthesis. A single stroke remedy for these two problems has been achieved through an *in-situ* aqueous photoreduction void of even trace amounts of SRA with an enhanced activity. Reduction of $PtCl_6^{2-}$ salt to Pt nano particles on carbon substrate was achieved solely using solar spectrum as the source of energy and TiO_2 as photocatalyst. Here, we demonstrate that this new procedure of photoreduction, decorates Pt over different types of conducting allotropes with the distribution and the particle size primarily depending on the conductivity of the allotrope. The $Pt/C/TiO_2$ composite unveiled an ORR activity on par to the most efficient Pt based electrocatalyst prepared through the conventional sacrificial reducing agent aided preparation methods.

Nanostructured Materials Embedded in Polymer Matrix for Catalysis and Sensor Applications

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Metal nanostructured materials find extensive applications in various applications including in catalysis and sensors due to their unique properties arising from their different size, shape and environment. Bimetallic nanoparticles attracted much attention due to their unique optical, electronic, magnetic, and catalytic properties, which are different from those of their respective monometallic nanoparticles. Synthesis of bimetallic nanoparticles with controlled size, shape, composition, and surface properties is a challenging task as the properties vary largely with shape, composition, and size.

Core-shell bimetal nanomaterials are very interesting catalytic materials when compared to their monometal counterparts. In particular, the gold/silver (Ag/Au) bimetal nanomaterials have attracted much attention in recent years. The methods of preparation of nanostructured materials highly influence the catalytic and sensing properties of the materials. Recent reports showed that the functionalized polymer matrix was used as support material for the nanostructured materials and the modification very much enhanced the catalytic properties of the materials. We have been utilizing the functionalized polymer matrix as reducing agent as well as stabilizing agent for the preparation of nanostructured materials. We have reported the preparation of new classes of metal core coated with thin shells of another metal of mono- and bi-layer (ex., gold core and silver shell) and their corresponding catalytic and sensing properties are also reported. In this lecture, the design and facile preparation methods, characterization and applications of novel nanostructured materials will be discussed in detail.

The Role of Electrode Material for Renewable and Self-Powered Hybrid Energy System

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Self-sustainable integrated energy storage systems can be the most plausible solution since we are on the verge of a global energy crisis due to rapid dissolution of fossil fuels. Finding environmentally benign fossil fuel replica with a broad performance spectrum is still a very encouraging field of research.[1-3] Increasing craze of portable electronics and hybrid vehicles are raising the bar for the model energy storage systems with high specific energy and power.

Recently we have explored the synthesis of highly conductive graphene film by using laser irradiation method that shows advancement for the fabrication of metal-free robust device. The array of microsupercapacitor device was integrated with a commercial solar cell module (Fig. 1) for hybrid energy harvesting and as a storage device.[1] This study provides an effective strategy to build a metal free supercapacitor with exceptional cycle life and facilitates progress towards self-sustainable energy in the future.Various efforts have been made in order to make the water splitting system self-powered and operate without the supply of any external power. The main powering unit in self-powered water electrolysis was solar cell, which is intermittent in nature. Thus, the choice of such a system, which provides an uninterrupted supply of fuel, is desirable. Here, our catalyst[2] successfully assembled in a two-electrode electrochemical cell for overall water splitting powered by commercial solar cell with an extraordinary stability of 150 h.

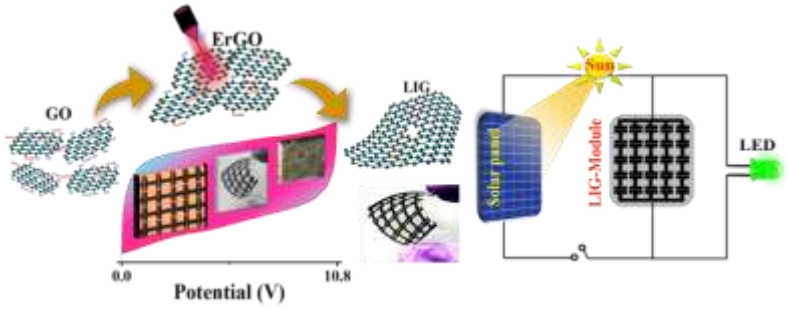

Fig. 1. Schematic representation for the synthesis of LIG film and assembled hybrid device with solar cell

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Microstructural Design of Precursor Derived Nanostructured Ceramics Towards Structural and Functional Applications

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Polymer derived ceramics (PDC) as structural ceramics for high temperature applications have been intensely studied in the recent few years. The as-thermolysed ceramic is often amorphous and is found to possess exceptional thermo-mechanical properties such as high temperature stability, oxidation and creep resistance. At higher temperatures, these ceramics undergoes phase separation and crystallization, leading to the formation of ceramic nanocomposites. Moreover, incorporation of additional transition elements into silicon oxycarbide and silicon carbonitride ceramic systems offers interesting potential in terms of thermal stability, improved mechanical properties and also possibilities to fine-tune functional properties. In this context, the effect of incorporation of Zr and Hf into the Si-C-O/Si-C-N ceramic matrices is explored. The synthesis involves the chemical modification of polysiloxane and polysilazane by zirconium tetra(n-propoxide) and hafnium tetra(n-butoxide) for the production of SiZrCN(O) and SiHfCN(O), respectively. The X-ray diffraction data revealed that the as-thermolysed ceramics are essentially amorphous up to 800 ˚C. Further, heat-treatment resulted in the phase separation and crystallization of t-ZrO_2 and t-HfO_2, from the SiZrCN(O) and SiHfCN(O) system, respectively (Fig.1). The talk will also encompass a prototypical example of crystallizing nanocrystals of nitrides which exemplify plasmonic behavior. Such refractory nitride nanoceramics find tremendous potential in variety of applications and we show how plasmonic properties can be used for photocatalysis as an example.

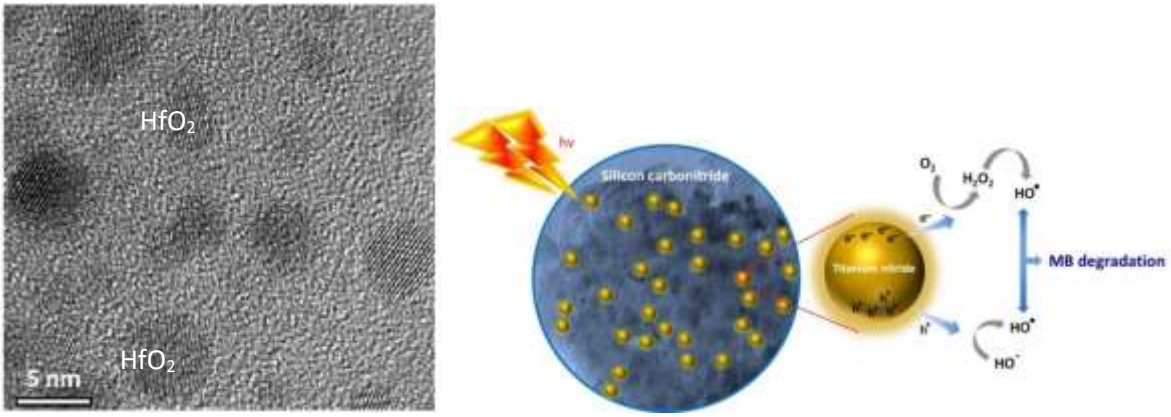

Fig. 1 HR-TEM image indicating the presence of hafnia crystallites in the metal oxide modified ceramics (left image) and schematic of TiN nanocrystals in a porous ceramic matric exemplifying photocatalytic activity in visible wavelength regime (right image).

Engineering at the Nanoscale: A Strategy for Developing High Performance Functional Polymer Nanocomposites

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The talk will concentrate on various approaches being used to engineer materials at the nanoscale for various applications in future technologies. In particular, the case of clay, carbon nanostructures (e.g. nanotubes, graphene), and metal oxides, bionanomaterials (cellulose, starch and chitin) will be used to highlight the challenges and progress. Several bio-degrdable polymer systems will be considered such as rubbers, thermoplastics, thermosets and their blends for the fabrication of functional polymer nanocomposites. The interfacial activity of nanomaterials in compatibilising binary polymer blends will also be discussed. Various self-assembled architectures of hybrid nanostructures can be made using relatively simple processes. Some of these structures offer excellent opportunity to probe novel nanoscale behavior and can impart unusual macroscopic end properties. Various applications of these materials, taking into account their multifunctional properties and some of the promising applications of clay, metal oxides, nano cellulose, chitin, carbon nanomaterials and their hybrids will be reviewed.

Technology Development and demonstration of Nano Functional Coatings for Eco-Friendly Concentrated Solar Thermal and PV applications

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Industrial sector needs both power and thermal energy for their manufacturing processes. More recently, Indian industries shown great interest in exploit renewable energies, especially solar energy, due to their economical and environmental-friendly advantages. Solar Photovoltaic (PV) and Solar Thermal (Concentrating Solar Power (CSP) / Concentrating Solar Thermal (CST)) can support for power generation and industrial process heat applications. Remarkably, solar PV technology has been reached a mature level cost by continuous efforts from the past few decades after publicized national solar mission programme whereas concentrating solar power (CSP) is too low compared to PV due to some challenges. The critical challenges for CSP are related to the lack of reliability of direct normal irradiance (DNI) data-base and lack of indigenous CSP components such as mirrors, receiver tubes etc. But there is high potential for widespread adoption of CST technology in India, especially for industrial process heat applications typically operated in the range of 90 to 250°C.

Apart from CSP/CST technology, another major issue related to PV Technology in India is the "DUST MITIGATION" problem. In general PV panels are needed in street lighting, traffic signals, operating small home appliances and power production. Traditionally, the panels are mounted outdoors on rooftops or in wide open spaces to maximize their exposure to sunlight. Unfortunately, this type of outdoor placement leads to continuous exposure of the solar panels to weather and moisture. Accordingly the devices have to be designed for many years of stable and reliable operation against such damage. Moreover, their conversion efficiencies, typically in the 20% range, are reduced by dust, dirt, pollen, and other particulates that accumulate on the panels. Power capabilities of an uncleaned solar panel in high dust area can drop by 30-40%. In view of the above, the presentation will focus on the importance of cost-effective development of functional materials and coatings from laboratory to industrial scale, their prototype development and performance in the real field conditions and challenges in technology transfer to the industry.

Nano-Spectroscopy and Nanoscopy using Plasmonic

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Spectroscopic imaging is a potential technique for studying properties of nanostructures without the use of nano-manipulator. Optical microscope based conventional techniques, however is limited by sub-diffraction limit. Plasmon is a collective oscillation of conduction electron which helps elctromagnetic wave to behave differently in the evanescent way. The later makes the light to find objects which are far beyond its reach.

Plasmon assisted tip enhanced Raman spectroscopic (TERS) studies of semiconducting system will be discussed at nanoscale. Electronic effect on the phonon characteristic of single Si nanowire, at the heterojunctions of 2D-chalcogenides will be discussed. In this regard, we will also discuss near-field scanning optical microscopic (NSOM) study of GaN nanowires and surface plasmon polariton in 2D electron gas of surface electron accumulation for InN nanostructures.

Development of Permanent Magnetic Thin Films for Sensor and Actuator Applications

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The surge in discoveries of new magnetic phenomena makes the study of magnetic films a fascinating topic of current research interest. One such recent evolution is magnetic micro-electro-mechanical-systems (MEMS), wherein electro-dynamic or electro-magnetic transduction schemes provide forces and torques for the requisite energy conversion. In particular, as compared to the electro-static actuators, the micro-actuators based on magnetic actuation principles provide a number of advantages such as low voltage and low power consumption together with large actuation forces.

A key challenge in magnetic MEMS is the realization of large-volume, high-energy-product thin film permanent magnets that can be deposited in a fully-integrated and CMOS-compatible manner. Such micro-magnets are essential in applications ranging from biasing of magnetic sensors in a portable compass to high force MEMS magnetic actuators to energy harvesting. A number of thin film permanent magnets possessing excellent intrinsic magnetic properties have been discussed in the literature. In order to achieve higher extrinsic properties such as magnetic flux, an intuitive approach is to simply increase the film thickness. However, it is observed that as the film thickness increases, the intrinsic magnetic properties, such as remanence and maximum energy product often deteriorate, limiting the maximum achievable magnetic fluxes from these small-scale integrated magnets.

This lecture provides a brief overview on a micro-fabricated permanent magnet with a multilayer structure that preserves the high energy density in thinner magnetic films while simultaneously achieving a significant thickness and resultant extrinsic properties. The fabrication process relies on sequential multilayer deposition: alternating layers of relatively thin hard (20-nm $SmCo_5$) and soft (4-nm Fe) magnetic materials were sputter deposited in a multilayer fashion realizing a micro-magnet with total thickness of ~1 μm. A maximum energy product as high as 36 MGOe was achieved in the $[SmCo_5/Fe]_{11}$ thin film magnet. Besides, a special emphasis on the proof-of-concept for micro-magnetic actuator and pressure based on thin film permanent magnets is given.

Keywords: Permanent magnetic thin films; Micro-magnetic devices; Sensors; Actuators.

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Recent Advances in Nanocarbon Materials for High Energy Symmetric/Asymmetric Supercapacitors

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Supercapacitors based on nanocarbon-based electrode with suitable electrolytes is continuously being developed to enhance the performance of the device. Nanocarbons with tenable pore size, surface area and pore volume have been reported for supercapacitor applications and their influence on the device performance also have been demonstrated. It has been proposed that combination of mesopores and micropores nature in the electrode materials is essential for realizing high specific capacitance. On the other hand, various electrolytes such as aqueous, organic and ionic liquids have also been investigated with different porous carbon materials and it has been found that the specific capacitance was not linear with the specific surface area. It is believed that the nature of the electrolyte, size of the ions and its solvation in the electrolyte has significant role when pores electrodes have been used. However, it was observed that there is no direct correlation between the size of the ions and pore size of the electrodes. Though, several mechanisms have been proposed for the adsorption of ions on the carbon surface and pores, the exact mechanism has not been deciphered to-date with a holistic understanding. It is presumed that the nature of the ion adsorption site in the porous carbon, pore size, shapes and adatoms also play a key role. Herein, we demonstrate a scalable and facile route to prepare a bio-derived carbon porous carbon and its superior performance in electrochemical supercapacitor. Further, the role of electrolyte on the specific capacitance, energy and power density of the supercapacitor will be discussed in detail. Finally, the fabrication of supercapacitor cell assembly with different configuration such as symmetric and asymmetric configuration and their electrochemical performance will be discussed.

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Accelerating Nanomaterial Simulations Using Machine Learning Techniques

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Progress in computer and methodologies enables reliable simulations on various topics concerning structures and properties of nanomaterials and phenomena occurring in nanomaterials using first-principles methods such as density functional theory (DFT). However, some of important topics still demands practically too heavy computations, such as ion diffusion in amorphous materials, thermal transport in defective materials, atomic structures of complex interfaces, etc.

Recently, machine learning techniques have attracted much attention because of their capability to achieve computational efficiency and reliability simultaneously in nanomaterial simulations. In this talk, I will demonstrate their capability with showing our recent results on the construction and applications of interatomic potentials optimized using DFT calculation data and one of machine-learning techniques, neural network. I will mainly discuss Li ion diffusion in amorphous Li_3PO_4 [1] and thermal conductivities of wuitize GaN and silicon crystals [2], and will also touch on the Born effective charges of Li_3PO_4 [3], atomic structure of metal/solid-electrolyte interface [4], and atomic energy mapping [5].

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Quantum Transport on Topologically Protected Flat Bands of ABC-stacked Multilayer Graphene

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ABC stacked multilayer graphene by tight binding calculations has been shown to be an N-layer generalisation of graphene[1–4], possessing a Berry phase of $N\pi$ and topologically protected flat bands with a dispersion relation of p^N. Despite its possession of flat bands which are susceptible to various many-body interactions including ferromagnetism and superconductivity, due to the Bernal stacked graphite being the more stable phase, electronic transport of rhombohedral graphite has been limited to only a few graphene layers[5,6]. In this talk I will report electronic transport measurements of ABC stacked systems up to and exceeding 20 layers. I will be reporting a spontaneous metal insulator transition happening at the flat bands. Through Landau fan spectroscopy I will be highlighting similarities and the differences to the existing theoretical work.

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Fabrication of Semiconductor Nanowires for Next Generation Devices

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Nanomaterials hold a great fascination because they have different fundamental physical properties compared to bulk materials due to the very small size. Nanomaterials have been widely applied in catalyst, bioimaging, analytic sensing and environmental applications which have stimulated research into the discovery, understanding and control of the morphology of materials at nanoscale. Here, we reported how to tailor nanocrystals by solution phase synthesis. One-dimensional Germanium nanowire and Zero-dimensional tin sulphide quantum dots with controlled size and shape were successfully fabricated. Recently, significant efforts have been spent on the development of nanomaterials-based high-capacity and high-charge rate batteries. In the past few years, a variety of lightweight metal matrix nanocomposites with superior mechanical and physical properties have been investigated. They are very promising materials for various of engineering applications such as aerospace and automobile industries.

Our research group current projects mainly focus on the development of nanostructure materials for the applications in lithium batteries such as anode materials for lithium ion batteries and solid electrolytes for all-solid-state lithium batteries. More recently, we are starting to develop nanomaterials which can lock up oxygen in titanium to achieve high strength-ductility synergy.

Carbon Based Nanotechnologies for the Future

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The carbon nanostructured materials are some of the most widely studied materials of the past few decades. This is due to the rich physics that can be observed in these systems. In this talk I will present some of the recent develops with regard to fundamental and applied physics of some of the carbon-based allotropes studied by my group. Carbon nanotubes are quasi-one-dimensional conductors and have been investigated for a range of novel applications. As carbon nanotubes can be chemically modified, they provide an ideal platform for tuneable electronic application. We have investigated the possibility of attaching nano-scale molecular magnets to multi-wall nanotubes. By performing low temperature studies including transport and magnetic susceptibility measurements, we have observed spin correlations such as a mesoscopic Kondo-effect as well as spin valve switching. Such findings open the possibility of using magnetic functionalized nanotubes as a platform for novel spintronic application. Furthermore, I present some of the anomalous transport features recently observed in superconducting boron doped diamond. This includes indications of a 2D structure observed in high resolution electron microscopy imaging that leads to modification of the transport properties. The granular nature of the film leads to interesting electronic correlations of the superconducting phase, including possibility of a BKT transition and formation of an anomalous bosonic insulator phase. Additionally we have identified signatures of a bound state related to unconventional pairing and possible triplet state. In the final section of the talk I will present some of our more recent developments regarding the fabrication of a superconducting diamond qubit composed of SQUID loops thus harnessing the unconventional superconducting phase for novel qubits. This is done by using state-of the Art He ion source focused ion beam milling. These findings are important for demonstrating how carbon will be useful for next generation quantum technologies.

Unusual Magnetodielectric Behaviour of Antiferromagnetic Pyrochlore Cobalt-Orthogermannate

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We report a detailed high temperature ($300K \leq T \leq 623K$) dielectric properties and low-temperature ($5K \leq T \leq 50K$) magnetodielectric behaviour of Pyrochlore Cobalt-Orthogermannate ($GeCo_2O_4$). Below the antiferromagnetic Néel temperature TN (20.4 K) of this compound two new field induced transitions (at 44 kOe and 57 kOe) were noticed in the magnetodielectric data ([εR(80kOe)-εR(0)]/εR Vs. H). The temperature dependence of relative dielectric permittivity εR(T) exhibits a sharp transition across 493 K (T*) along with two weak anomalies (at 397K (T1) and 592 K (T2)) on either side of this main transition T*. These new anomalies are accompanied by a broad hump in the temperature dependence of loss-tangent Tan δ(T) of $GeCo_2O_4$. A significant dispersion of the peak positions for both the transitions T* and T1 was noticed with increasing the ac-driving frequency ($100Hz \leq f \leq 20MHz$). On the other hand, the low-temperature behaviour of εR(T) shows a feeble anomaly across the TN.
Keywords: Spinels, Magnetodielectric, Pyrochlore, Electronic Structure, FTIR Spectroscopy.

Metallic Glass Thin Films for Potential Biomedical Applications

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Amorphous metallic alloys or metallic glasses are lucrative engineering materials owing to their superior mechanical properties such as high strength and large elastic strain. Most of the metallic biomaterials are bioinert and some of them can cause concerns over their long term implantation as they cause corrosion and release cytotoxic metal ions to surrounding body tissues leading to the failure of implants. Forming bioactive and corrosion resistant coatings on implantable metals combats these problems and makes these materials very attractive for medical applications.

In order to identify new biologically safe glass forming Ti-based compositions for biomedical applications, quaternary Ti-Cu-Pd-Zr and Ti-Nb-Zr-Si metallic glasses in thin films were fabricated by sputtering on Ti substrates. A suitability evaluation concerning glass forming ability, thermal stability, mechanical and biocompatibility were performed and the results will be discussed. Biodegradable PCL with different weight percentage were electrospun to form nanofibrous scaffold. In order to enhance the bioactivity, magnesium metallic glasses were sputtered over the PCL scaffold and the results will be discussed. A serious problem in implant materials, namely assimilation, whereby calcium phosphate precipitates from body fluids over Ti metal implants might result in bone re-facture during removal operation of the implanted devices after healing. To control such assimilation, physical vapor deposition of Zr-Cu-Al-Ag metallic glass thin films and ZrO_2 on Ti substrate was carried out and these results will also be discussed.

Nano Structured Materials for Energy Storage Devices

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Nanostructures form the basic building block of all natural systems, which has been used as material design concept to obtain high surface area, functional, stable material for sustainable clean energy catalyst and conductor materials. The different nanoscale architectures like nanofibers, nanospheres, core-shell structures, nanoflower, nanograss, and nanosponge, are some of the structures used as photocatalysts and electrocatalysts in energy storage applications, e.g, Na-ion battery, solid oxide fuel cell (SOFC), water splitting to produce hydrogen.

Nanofibres and nanograss are 1-d/2-d nanostructures with a considerable amount of surface area but have very limited poly-crystallinity. Core-shell nanostructures are categorized as 0d nanostructures. When aggregated it presents large surface area with high porosity, but the channelization of charge carriers limit its use. Nanoflowers and nanotubes are connected to the metallic core and channel the electron/holes, but the use is limited by the difficulty of sensitization. Despite given limitations, all such nanostructures are widely used in energy stoarge devices overriding the implications of the limitations. For example, nanocatalyst in A site or B site doped $SrTiO_3$ perovskite structure and core-shell nanostructures are used as the morphology of choice for the catalysts in SOFC for energy generation. Sensitized nanoflowers and nanotubes transition metal oxides and spinels e.g., C_3N_4/TiO_2, $NiCo_2O_4$, $ZnCo_2O_4$ are used for photo-electrochemical water splitting and hydrogen generation. Such examples with structural and functional relationships among different materials, e.g., carbon [1-2], transition metal oxides[3-5], rare earth [6-10], perovskites [11], will be discussed in this paper.

In the context development of Na-ion battery, stable sodium plating/stripping has been achieved on bare aluminium current collector, without any surface modifications or artificial solid electrolyte interface deposition. DFT simulations have been performed to obtain the solvation energies, and the HOMO-LUMO band gap of the solvent-sodium ion complexes for the glyme solvent electrolytes and their trends have been correlated with the experimental observations. The study highlights the difference of sodium plating/stripping in carbonate and glyme solvent electrolytes on the bare aluminium current collector and emphasizes on the role cycling protocols with and without the pre-deposition play in ensuring stable and efficient cycling of sodium in anode-free sodium batteries without dendritic formations and electrolyte decomposition.

Gas Sensors with Different Nano Structured Materials and Its Characterization

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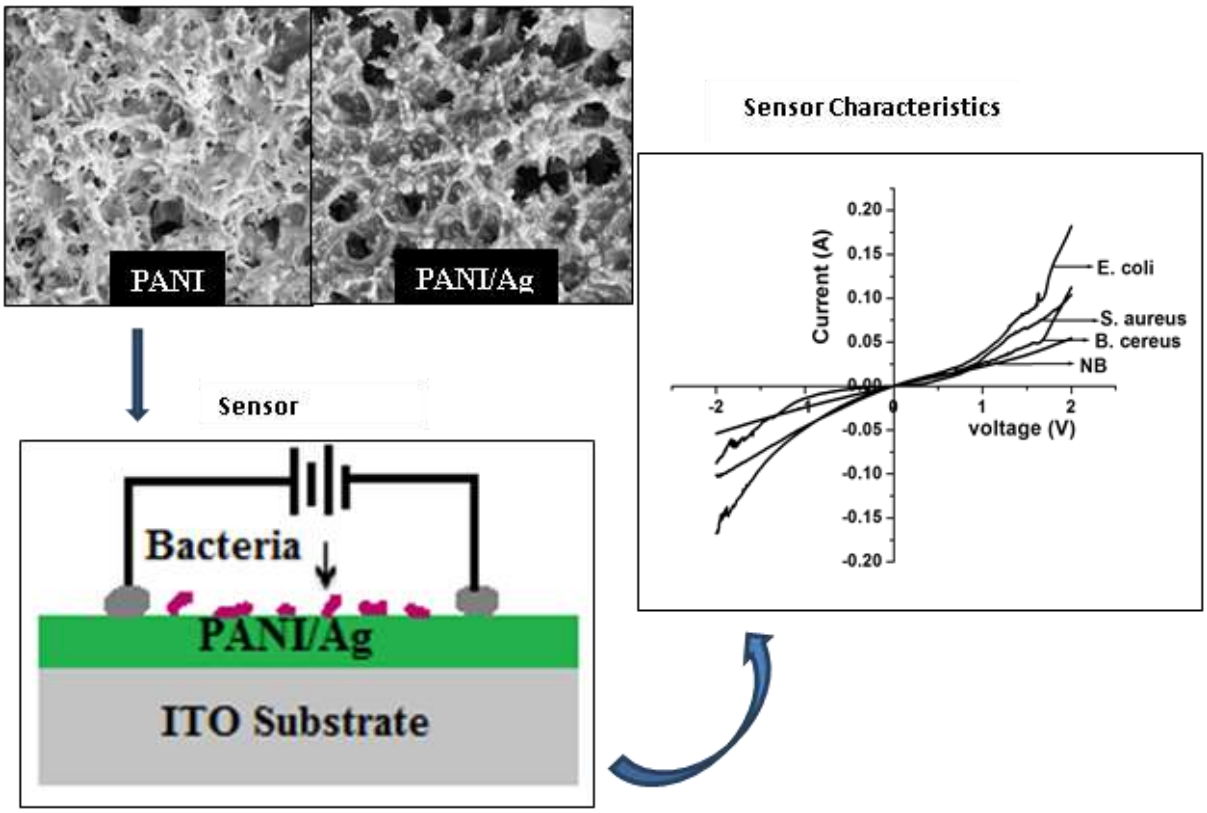
Gas detection is important for controlling industrial and vehicle emissions, household security and environmental monitoring. The low selectivity or the high operation temperatures required when most gas sensors are used have prompted the study of new materials and the new properties that come about from using traditional materials in a nanostructured mode. In this study we have discussed the main research studies of various (CNT, ZnO, ZrO_2) nanostuctured materials sensors under different gases. The main quality characteristics of these new sensing devices have enabled us to make a critical review of the possible advantages and drawbacks of these nanostructured material-based sensors.



In-situ TEM Study of Temperature Dependent Growth of Embedded Ge Nanostructures in SiO_x/Si Matrices

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Semiconductor nanostructures embedded inside dielectric matrices have been of great interest due to its well found applications in various fields such as optoelectronics and thermoelectrics. For example, Ge and Si quantum dots are currently being studied, as the resulting quantum confinement effects in such systems influence the performance of the devices. Low energy ion implantation is one of the most preferred technique. It gives the liberty to choose the size and the depth of embedded nanostructures by tuning the fluency and energy of the implanted ions respectively. In this work, ions of 3 different energies have been used, accompanied by varying fluencies. Ge ions are implanted into a thermally grown SiO_x film on Si(100) substrate by low energy ion-implantation technique. *In-situ* study of growth of these implanted ions into nanoparticles inside SiO_2 matrix at varying temperatures will be discussed. XTEM studies show embedded nanostructures in the Si matrix, Si/SiO_x interface and SiO_x matrix depending on the energy of the ions.

Keywords: ion implantation, embedded nanostructures, *in-situ* annealing.

Nanomaterials based Microextraction Techniques Coupled with HPLC-MS/MS for the Rapid Analysis of Toxic Compounds in Complex Samples

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Conventional sample preparation techniques have been significantly substituted in recent years by miniaturized sample preparation methods. A new miniaturized version of solid-phase extraction (SPE) technique known as pipette-tip based SPE method grabbed much research attention. Due to the necessity for highly sensitive extraction techniques become invoking significant; therefore it is vital to investigate new extraction sorbents with maximum extraction capacity for PT-SPE methods. We demonstrate an auto-syringe infusion pump (ASIP) assisted nanomaterials based pipette-tip micro-solid phase extraction (PT-µSPE) technique for the rapid determination of various toxic compounds in aqueous samples using high-performance liquid chromatography with tandem mass spectrometer (HPLC-MS/MS). In this study, nanomaterials packed micropipette tip coupled with a plastic syringe (containing sample solution) was connected to a programmable auto-syringe infusion pump for the PT-µSPE process. The extraction efficiency and feasibility of ASIP-GNSs-PT-µSPE for the analysis of toxic compounds were systematically studied and optimized. Under the optimal experimental conditions, excellent linearity was achieved over the concentration range of 0.1–250 ng mL^{-1} for the target analytes and the limit of detections were less than 0.1 ng mL^{-1}. The applicability of the present method was examined with real water samples, and the extraction recoveries ranged from 90 – 105% and relative standard deviations were less than 5%. The presented method is simple, semi-automated, economical, efficient and eco-friendly sample preparation technique for the analysis of toxic compounds and it can be applied as an alternative technique over conventional extraction methods for the analysis of various target analytes in aqueous samples.

Keywords: Nanomaterials; Pipette tip micro-solid phase extraction; High-performance liquid chromatography; Mass spectrometer, Aqueous samples.

Device Realization with Nano-Structured Solid Ionic Electrolyte for Oxygen Sensor

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Oxygen sensor assembled with nanocrystallized ionic conductive solid electrolyte and applicable at low exhaust gas temperature will be presented in this talk. The aim of the research is to fabricate the oxygen sensors available at low temperature, monitoring the air-fuel ratio at low temperature to control the emission of exhaust at auto start and/or at low speed running. This presentation will talk about the preparation of nanofiber and multilayer solid electrolyte materials, the structure, and their ionic conductivity properties at low temperature. The process of assemble and performance of the sensor will be introduced.

Keywords*:* Oxygen sensor, solid electrolyte, nano materials.

Functional Carbon Materials for Optoelectronics, Energy and Environmental Applications

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Carbon materials containing conjugated pi bonds, have unique physical, chemical and biological properties. Pi conjugated molecules, semiconducting polymers, nano carbons and porous carbon materials have found wide application in the optoelectronics, energy and environment. The pi-conjugated molecules, semiconducting polymers, fullerenes, carbon nanotubes (CNTs) and graphene are important carbon materials for optoelectronics devices, such as field-effect transistors (FETs), photodetectors, solar cells and sensors. Several novel carbon nano materials have been prepared from inexpensive raw materials (such as natural gas, coal, biomass, plastics and so on) by low cost processes. Some of these carbon materials have been chemically doped by nitrogen or contains chemical functional groups. The porous carbon materials have tailored pore structures, high surface area, excellent electrical, electrochemistry and optical properties, making them be ideal for many emerging applications, such as batteries, supercapacitors and solar seawater desalination devices. Ultrahigh surface area (up to 1740 m^2 g^{-1}), hierarchical porous carbons have been derived from the dehalogenation of low cost, widely available plastics (such as polyvinyl chloride, PVC) with simple, low cost, environmentally friendly processes. The broad hierarchical pores (from 2 nm to 20 μm) facilitate and ensure fast water and vapor transportation. Geopolymer–biomass mesoporous carbon composite (GBMCC) has been used for harvesting solar and wind energy, to generate drinking water from sea water by steam generation. The GBMCC device boosted water evaporation rates up to 1.58 and 2.71 kg m^{-2} h^{-1} under 1 and 3 suns illumination, with the solar thermal conversion efficiency up to 84.95% and 67.6%, respectively. A remarkable, record high water vapor generation rate of 7.55 kg m^{-2} h^{-1} is achieved under 1 sun solar intensity at the wind speed of 3 m s^{-1}. The carbons materials also have huge potential to tackle the environmental and health care challenges, as key components in gas sensors, water filters, air purifiers and healthcare devices.

Keywords: Functional Carbon Materials, Optoelectronics, Batteries, Supercapacitors, Solar Steam Generation.

Abstracts for Oral and Poster Presentations

ABICNAN201910017

Control over Number of Graphitic Layers in Carbon Nanotubes: Role of Sulfur

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Role of two sulfur sources such as thiophene and carbon disulphide on the structure (graphitic layer) of carbon nanotube cotton (CNT-c) has been investigated. CNT-c assembly was found to be predominantly consisting of single-walled carbon nanotubes (SWCNTs) in presence of carbon disulphide and multi-walled carbon nanotubes (MWCNTs) in presence of thiophene at 1200 °C with ferrocene and ethanol as catalyst and carbon precursors, respectively. A possible mechanism for having two different structures has been discussed. The experimental results demonstrated that the interaction of sulfur source with the catalyst particle strongly influence the number of graphitic layers of CNTs in CNT-c assembly.
Keywords: Carbon nanotube cotton, Floating catalyst, Sulfur, Raman spectroscopy, Electron microscopy.

ABICNAN201910018

Dielectric Properties of PMMA/ZnO Nanocomposite Film with Irradiation of 8MeV Electron Beam

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In this study, PMMA with ZnO polymer Nanocomposite films were irradiated with electron beam (EB) at 50 and 150 kGy. The induced chemical changes in films due to irradiations have been confirmed from The X-ray Diffractometry (XRD) results show that crystallinity decreases by ~20% in EB irradiated films respectively compared to non-irradiated film. The microstructural arrangement was investigated by Scanning Electronic Microscopy (SEM) and the images reveal that there is a substantial improvement in the surface morphology in irradiated films. The real (ε') and imaginary (ε'') dielectric constant and AC conductivity are found to increase with increase in irradiation dose.
Keywords: Polymer Composite, XRD, FT-IR, Dielectric permittivity, Radiation effect.

ABICNAN201910020

Acid Catalyzed Cross Aldol Condensation in Micellar System

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The present work includes study of acid catalyzed cross aldol condensation between benzaldehyde and cyclohexanone to yield α,α'-bis benzylidene cyclohexanone as dicondensation product (major) using micellar system. Use of organic solvent is restricted in the present study. In our study, we found that p- Toluenesulfonic acid (PTSA) catalyst and Sodium Dodecyl sulfate (SDS) surfactant gave the results in terms of conversion (63%) of cyclohexanone and selectivity (91%) of cross aldol product as compared to other surfactant – acid combination. Acid is incorporated towards inner core of micelle as H+ from acid are attracted towards negative head group of surfactant and PTSA showed more participation in the reaction giving better results.

Keywords: Surfactant, Micelle.

ABICNAN2019100021

A Novel Ionic Liquid Based Electrochemical Sensor for Detection of Pyrazinamide

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In this work, we report electrochemical detection of pyrazinamide at the surface of a glassy carbon electrode fabricated with a sensing nanocomposite of 1-ethyl-3-methylimidazolium tetrafluoroborate ([Emim][BF_4]) ionic liquid, reduced graphene oxide and silver nanoparticles. The electrochemical reaction of the pyrazinamide at modified electrode was measured using cyclic and differential pulse voltammetry methods. The transmission electron microscope results of the fabricated surfaces demonstrated the formation of nanoscale structures, representing successful electrodeposition and electro-polymerization processes to modify the glassy carbon electrode surface. Moreover, these results shown a linear electrochemical response to pyrazinamide within the concentration range from 3 μM to 24 μM with the limit of detection (LOD) and limit of quantification of 0.0102 μM and 0.3658 μM respectively.

Keywords: Ionic liquid, electrochemical sensor, pyrazinamide, differential pulse voltammetry.

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Structure, Growth and Cathodoluminescence Properties of Monoclinic $BaY_2(MoO_4)_4:R^{3+}$ ($R = Eu^{3+}, Pr^{3+}$) Thin Films Grown on Si(100) Substrate by Pulsed Laser Ablation Technique

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For the first time, monoclinic phase $BY_2(MoO_4)_4:R^{3+}$ ($R = Eu^{3+}, Pr^{3+}$) thin phosphor films have been grown on Si(100) substrates using a 266 nm Nd-YAG laser by using the pulsed laser ablation technique. The structure, target preparation and optimized growth conditions of the nano-sized thin films have been investigated in detail. The deposition was carried out in an ultra-high vacuum (UHV) with various oxygen back pressures (300 mTorr to 600 mTorr) at different laser energies (60 to 80 mJ). The crystal structure, three dimensional surface topography, film thickness were analyzed by X-ray diffraction, atomic force microscope) and scanning electron microscope, respectively. The thin films possessed a monoclinic crystal structure with the space group C2/c. The cathodoluminescence properties of Eu^{3+} and Pr^{3+}

doped $BY_2(MoO_4)_4$ thin films were investigated in detail. The color coordinates, color correlated temperature and luminous efficacy of radiation were analysed further. The as-synthesized nano thin films of Eu^{3+} and Pr^{3+}doped $BaY_2(MoO_4)_4$ phosphor can serve as an excellent material for electro/cathodo-luminescence and display applications.

Keywords: Lanthanide ions, Pulsed Laser Deposition Technique, XRD, Surface Morphology, Cathodoluminescence.

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Electrocatalytic Hydrogen Generation and Urea Electrolysis

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A class of organic-inorganic nanohybrid, electrodeposited on carbon paper is developed for electrocatalytic hydrogen production and urea electrolysis. The electrodeposited nanohybrid of dipeptide and metal hydroxide is stable in aqueous electrolyte solution and exhibits excellent electrocatalytic performance for urea oxidation reaction (UOR) along with hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). Taking advantage of good conductivity of organic-inorganic nanohybrids developed electrocatalyst displays superior electrocatalytic UOR, HER and OER performance with low overpotential. Additionally, carbon paper supported organic-inorganic nanohybrid shows lower overpotential in presence of urea than urea-free medium in two electrode based system demonstrating energy efficient hydrogen production.

Keywords: organic-inorganic nanohybrid, OER, HER, electrolysis, urea oxidation.

ABICNAN201910025

Transforming ZIF-67 into Amorphous Co-N-Se nanosheets for Efficient Water Oxidation

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Metal-organic frameworks (MOFs) represents a class of porous solids wherein a metal atom node is linked with multitopic organic linkers. Owning to their expansive chemical diversity, MOFs have shown tremendous potential for a wide range of applications including organic synthesis, photocatalysis, gas storage and environmental remediation. Recently, efforts have been made to apply MOFs for electrocatalysis as they can afford the inherent advantages of both homogenous and heterogenous catalysts. Unfortunately, their intrinsically poor conductivity and slow charge-transport are a major roadblock towards successful realization of MOF-based electrochemical devices. Oxygen evolution reaction (OER) lies at the heart of various clean energy technologies such as water electrolyzers, metal-air batteries etc. However, the sluggish four-electron transfer process involving O-H bond breaking and O-O bond formation seriously impedes large scale hydrogen generation via water splitting. Even though precious metal oxides such RuO_2 and IrO_2 are currently employed to overcome the drawbacks

associated with OER kinetics, their high cost and limited availability throttles any significant efforts towards their widespread realization.

Herein, we demonstrate a low temperature method to transform ZIF-67 into hierarchal porous, amorphous Co-N-Se nanosheets. By simply varying the reaction time - an effective handle to regulate the degree of MOF-conversion was achieved and thereby providing an opportunity to fine tune the chemical composition and the porosity of Co-N-Se nanosheets. By the virtue of its abundantly exposed catalytically exposed sites and improved mass transport of the reactants/electrolyte, the amorphous Co-N-Se nanosheets were found to be a highly active and stable electrocatalyst for OER, even outperforming the state-of-art RuO_2. Mechanistic insights into the transformation of ZIF-67 into amorphous Co-N-Se nanosheets was obtained by X-ray absorption spectroscopy (XAS) which revealed that the amount of Co^{3+} active sites could be correlated to the overall OER activity of the system. Information gained from structure-property correlation studies of these kinds would be important to design efficient MOF-based electrocatalysts in future.

Keywords: Organic, electrolytic, amorphous.

ABICNAN201910026

Synthesis of Boron and Nitrogen Co-Doped Carbon Nanotubes and Their Application in Hydrogen Storage

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Floating catalyst chemical vapor deposition method was used for the synthesis of Boron and nitrogen codoped carbon nanotubes (B, N-CNTs) using ethanol, boric acid, imidazole and ferrocene as carbon, boron, nitrogen and catalyst sources respectively. For B, N-CNTs, the hydrogen adsorption behavior was studied using Sieverts' apparatus. At 16 bar, hydrogen adsorption values are 1.96 and 0.35 wt% at 77 K and 303 K temperature, respectively. The increased hydrogen storage as compared with pristine CNTs depicts role of codoping boron and nitrogen. Detailed analysis of adsorption curve depicts presence of pseudo second order kinetics.

Keywords: Chemical vapor decomposition, co-doping, hydrogen, adsorption.

ABICNAN201910027

One Pot Synthesis of MoS_2 Nanoflakes Decorated CuPc Rod and its Electrocatalytic Activity Towards Oxygen Reduction Reaction

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In recent years, search of non-Platinum based electrocatalysts are of major research interest. We, therefore, have synthesized and explored the electrocatalytic activity of copper phthalocyanine-MoS_2 heterostructure towards oxygen reduction reaction for the first time. A strong synergy is observed in between MoS_2 and copper phthalocyanine that results enhanced catalytic activity with respect to those in individual materials. This may be ascribed due to formation of well-decorated ultrathin MoS_2 nanoflakes over the rod with exposed edges. Such exposed edges of two dimensional flakes help to improve the reaction kinetics in electrocatalyis.

Keywords: Phthalocyanine, CuPc-MoS_2, electrocatalyst, oxygen reduction reaction.

ABICNAN201910028

Bismuth Vanadium Oxide and Cuprous Oxide Tandem Cell for Unassisted Solar Water Splitting

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N-type bismuth vanadate ($BiVO_4$) thin film and p-type cuprous oxide (Cu_2O) was fabricated by dip coating and electrodeposition method respectively. BiVO4 photoanode /Cu_2O photocathode were tested separately and also the feasibility of tandem cell for unassisted solar water splitting was evaluated. Co-Pi and FeOOH/NiOOH was used as water oxidation catalysts, and MoS_2 was used as cocatalyst for Cu_2O photocathode. The substrates were characterised with XRD, SEM and were confirmed with desired material which has high quality coating. Finally, unassisted 2 electrode solar water splitting was carried out. The stability of the unassisted solar water splitting was also obtained.

Keywords: Bismuth vanadate, cuprous oxide, solar water splitting, tandem cell, photocurrent.

ABICNAN201910037

Separation of N-Butanol from Aqueous Solution using PTMST- Silica Nano Membrane through Pervaporation

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Silica-filled poly(1-trimethylsilyl-1-propyne) (PTMSP) membrane was effectively used in the pervaporation separation of butanol/water mixtures. The effects of temperature, feedconcentration on the membrane pervaporation performance were investigated. The flux valueincreases from 0.43 to 0.72 g/cm2/min with increasing temperature from 37 to 63^oC and 0.72to 1.27 g/cm2/min with increasing butanol concentration from 1.5 g to 4.5 g/100L at 63^oC. Itwas found that at all three different temperatures the separation factor and selectivity is high at 3 g/100mL of butanol feed concentration.

Keywords: PTMSP, silica, butanol, water, pervaporation.

ABICNAN201910039

Nanoencapsulated *Tinospora Cordifolia* (Willd.) Using Poly (D, L-Lactide) Nanoparticles Educe Effective Control in Streptozotocin-Induced Type 2 Diabetic Rats

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The therapeuitcs for Type 2 diabetes mellitus has emerged in the current century towards nanomedicine incorporated with plant active compounds. In this study PLA Nanoparticles were loaded with *Tinospora cordifolia* stem extract and antidiabetic potential towards streptozotocin induced type 2 diabetic rats have been assessed. Furthermore, oral administration of TC loaded PLA NPs for 28 consecutive days to streptozotocin-induced diabetic rats had significant anti-diabetic effects also equal to common diabetic drug glibenclamide. The antidiabetic activity is due to the synergism of compounds present in stem extract of the plant which reduced the side effects and anti-diabetic effects also equal to common diabetic drug glibenclamide.
Keywords: Diabetes; Poly (D, L-Lactide); Serum profiles; Liver markers; ELISA.

ABICNAN201910040

Optimization and Toxicology Evaluation of Copper Oxide Nanoparticles on the Embryonic Development of Zebrafish, (*Danio Rerio*)

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With the rapid development of nanotechnology, much has been anticipated with copper oxide nanoparticles (CuO NP) due to their extensive industrial and commercial application. However, it has raised concern over environmental safety and human health effects. In this study, CuO nanoparticles were synthesized using the green method with leaves extract of *Alternanthera sessilis.* The experiments were set up according to the design of the experiment Technique and the results were analysed for optimization of experimental parameters using response surface methodology centred Box–Behnken design and characterized by standard physiochemical techniques like DLS, Zeta potential determination, UV- Visible Spectroscopy, XRD, FTIR, SEM, and TEM. Physiochemical characterization of CuO NP determined the size and shape of synthesized nanoparticles to be 10 to 20 nm, respectively. Cytotoxicity evaluation with Zebrafish revealed malfunctioned organ development with differential viability and hatching rate at 48 hpf and 72 hpf. The study demonstrated valuable information on cytotoxic impact, which can be influential in further studies of their eco-toxicological effects.
Keywords: Toxicology, Box-Behnken design, Antioxidant activity, Zebrafish, ICP-MS.

ABICNAN2019100041

Purified Mesoporous Nickel Metal Organic Framework as Electrocatalyst for Hydrogen Evolution Reaction in Basic Medium

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Recently, research on metal organic framework (MOF) for HER application has attained much interest due to their porosity and well-defined structures. In this work, a nickel-MOF has been synthesized by simple solvothermal method and the same has been purified. Both impure and purified nickel-MOFs served as electrode for hydrogen evolution reaction (HER). Performance of MOF is affected due to the impurities present in the porous structure. Activation and purification is carried out to enhance the performance of MOFs. The electrochemical characterization proves high electroactivity of purified Ni-MOF with high rate kinetics towards HER then impure Ni- MOF. The Tafel slope of purified nickel MOF about 73.7 mV/dec which indicates the abundance catalytic active edge sites in pure Ni-MOF and also suggest that it is lay on volmer-Heyrvosky mechanism with electrochemical desorption of hydrogen as rate limiting step.

Keywords: Electrocatalyst, Nickel MOF, HER, Linear Sweep Voltametry, Tafel Slope.

ABICNAN201910042

Electrochemical Exfoliation of Graphite: Synthesis and Characterization of Graphene Oxide

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Recent development graphene and graphene derivative based technology holds promising results to change the current scenario of electronic, composite, medicinal technology. Here we demonstrate a synthesis of graphene oxide (GO) i.e. a derivative of graphene by electrochemical exfoliation method. Due to randomness of intercalation and exfoliation phenomenon, a control over morphology of graphene oxide is very difficult. Therefore, narrow distribution in thickness and lateral dimension is observed here. The exfoliation rate is also affected by applied current density, precursor quality and electrolyte. Characterization of obtained GO was done by Transmission electron Microscopy (TEM), Raman Spectroscopy, X-ray photoelectron spectroscopy (XPS).

Keywords: Electrochemical exfoliation, current density, graphene oxide (GO).

ABICNAN201910044

Photoresponse of Vertical 2d/3d Semiconductor Heterojunction Photodiode Based on Ag Decorated WS_2 Nanosheet and P-Type Silicon

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In this work, Ag decorated WS_2 a nanosheet is used to fabricate heterojunction photodiodewith silicon. Due to the incorporation of Ag atoms into the nanosheets of WS_2, the photovoltaic characteristics of the fabricated Ag-WS_2/Si device were enhanced largely. The IV analysis and photo response properties show that the device is highly sensitive to Visible-Infrared region of the visible spectrum. The diode exhibits a stable and reproducible time resolved photoresponse under visible-IR illuminations. To be specific, the Ag-WS_2/Si photodetector shows a maximum

photoresponsivity of 66.2 mA/W and detectivity of ~1010 Jones at -2 V. The present work demonstrated a facile large scale production of high performance photodetectors for the photo-elelectrochemical and energy applications.

Keywords: Tungsten disulfide, 1D/2D heterojunction, Vertical heterojunction, Photodiode, Photoresponsivity.

ABICNAN201910046

Preparation and Characterization of Polyhydroxybutyrate (PHB) Nanocomposites with Graphene Nano Platelets

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Polyhydroxybutyrate (PHB) nanocomposite were prepared by reinforcing graphene nanoplatelets (Gr-NPs) on PHB polymer via solution casting method. Gr-NPs of varying morphologies (change in surface area) and of varying concentrations were used in the present study to examine its effect on the thermal properties of the prepared nanocomposites. Gr-NPs having higher surface area demonstrated about 4oC enhancement in melting temperature (Tm) over pristine PHB. In the study on the effect of Gr-NPs concentration, an optimum Gr-NPs concentration of 0.7% (w/v) resulted in a 10^{o}C improvement of melting temperature in comparison with the pristine PHB.

Keywords: Polyhydroxybutyrate, Solution casting method, Graphene nanoplatelets, Nanocomposite.

ABICNAN201910047

Effect of High-Temperature Treatment of Sibunite on The Activity of Ru-CS(BA)/Sibunite Catalysts in Ammonia Synthesis and Their Resistance to Methanation.

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The study showed that an increase in the processing temperature of Sibunite increases the activity of ammonia synthesis catalysts and their resistance to methanation. The obtained catalysts were characterized by physicochemical methods of analysis.

Keywords: ammonia synthesis, Sibunite, rythenium catalysts, methanation.

ABICNAN201910049

Synthesis of Stable Oleylammonium-Methylammonium Mixed Tin-Lead Bromide Perovskites Using Ligand Assisted Reprecipitation Technique

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Methylammonium lead halides are the most popular material in organic-inorganic hybrid perovskite family because their optoelectronic properties are most suitable for photovoltaic and other optoelectronic device applications. But the obstacle in the path of commercializing these materials is their instability in the ambient atmosphere and the toxicity of lead. The toxic lead can be replaced with a non-toxic tin of the same group. In this work, we synthesized organo mixed tin-lead bromide perovskite nanoparticles using ligand assisted reprecipitation technique. The synthesized perovskite particles show an increase in band gap energy with an increase in tin concentration.

Keywords: Perovskites, mixed tin - lead perovskites, ligand assisted reprecipitation method.

ABICNAN201910051

Mesoporous CuO Nanocatalysts for Oxidative Degradation of Organic Dye Pollutants

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We have reported a two-stepped strategy to synthesized three mesoporous CuO nanocatalysts via precursor mediated precipitation route from different Cu-based salts. The prepared CuO are well characterized and employed for oxidative degradation of methyl orange (MO) and methylene blue (MB) dye pollutants at various temperature. The mesoporous CuO nanocatalysts exhibit diverse activity depending on their synthesis parameters and textural properties. Moreover, study on kinetic/activation parameters reveals that degradations are endothermic in nature following pseudo first order kinetics for the degradation reactions.

Keywords: Mesoporous, Nanocatalysts, Dye Pollutants, Degradation.

ABICNAN201910052

Mn^{2+} Concentrations Creating Defects in Chromium Sesquioxide (Cr_2O_3) Nanoparticles Influence The Enhanced Various Properties And Photocatalytic Activity: Synthesized via The Facile Precipitation Process

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Chromium sesquioxide (Cr_2O_3) nanomaterials were successfully synthesized via the facile precipitation method with different (1-3 mol %) concentrations of a Mn^{2+} metal ion as a dopant. The effects of metal ion dopant concentrations creating defects in the chromium sesquioxide nanoparticles were analyzed by different techniques. The structural, morphological, magnetic and optical properties of the products were studied by using XRD, FTIR, SEM, TEM, VSM, UV-vis and PL techniques. Photocatalytic degradation performances of the products were comparatively discussed with pure chromium sesquioxide nanoparticles methyl orange as a model dye solution.

Keywords: Chromium sesquioxide; Dopants concentrations; Structural and optical properties; Photocatalytic activity.

ABICNAN201910054

Facile Synthesis of Ni-Co-S/CTAB Nanocomposites for Selective Removal of Anionic Dyes from Dye Effluents and Adsorption Mechanism

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Ni-Co-S/CTAB nanocomposites have been synthesized at low temperature using water as a green solvent and nickel acetate, cobalt acetate, thioacetamide and Cetyl trimethyl ammonium bromide. The maximum adsorption capacity of nanocomposites are very high for anionic dyes 2011.62 mg g^{-1} for Congo red, 2229.33 mg g^{-1} for Methyl orange. They exhibit little adsorption ability towards cationic dyes 2.33 mg g^{-1} for Methylene Blue, 42.05 mg g^{-1} for Rhodamine B. It is able to adsorb anionic dyes form binary mixture of cationic and anaionic dyes with high separation factor. The dyes removal followed pseudo-second-order kinetics and modified Zhu and Gu model.

Keywords: Ni-Co-S/CTAB nanocomposites, Selective adsorption, Anionic dyes, modified Zhu and Gu model and Electrostatic interaction.

ABICNAN201910055

Forming-Free Nonvolatile Resistive Switching Memory Devices Based On PMMA Films with Embedded $MoSe_2$ Nanoflowers

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A nonvolatile bipolar resistive memory device were fabricated, with novel nanocomposite films that consist of PMMA and $MoSe_2$ nanoflowers, using a simple chemical rout with a configuration of Ag/$MoSe_2$@PMMA/ITO. The as-fabricated devices exhibit formation-free resistive switching (RS) with high resistance ratio (RHRS/RLRS) ~102 and high retention time (more than 103 s). From the experimental data, RS performances are explained by using charge trapping – de-trapping mechanism.

Keywords:Resistive Switching Device (RSD), Molybdenum diselenide($MoSe_2$), polymethyl methacrylate (PMMA), charge trapping-de-trapping.

ABICNAN201910056

Thermally Radiative Flow of a Viscoelastic Nanofluid with Newtonian Heating

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This research article inspect the impact of thermally radiative 3D viscoelastic nanofluid flow upon a stretchy paper with Newtonian heating. An appropriate similarity variables are used to remodel the governing non-linear PDE's to ODE's and they are analytically solved with

adopting the homotopy analysis method (HAM). The disparity of fluid velocities, temperature, nanoparticle volume fraction, skin friction coefficients and local Nusselt number of various parameters with remarkable discussions are pointed out. It is noticed that, enhancing the Newtonian heating parameter leads to rise the fluid temperature. Also found that the nanoparticle volume fraction enlarges with growing the thermophoresis
parameter.

Keywords: Viscoelastic nanofluid, Brownian motion, radiation, Newtonian heating and thermophoresis effects.

ABICNAN201910057

Synthesis of ZnO-Ni Flower like Nanostructure for Gas Sensing Application

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In the present work, we report the synthesis and characterization of nickel (Ni) doped ZnO flowers composed of aggregated nanorods done by hydrothermal process. The as –prepared sample was characterized by XRD, SEM-EDAX, FESEM, TEM etc. Structural and morphological results of the prepared nanomaterial confirmed the formation of the hexagonal wurtzite structure of Ni- doped ZnO flower .Furthermore, the gas sensing performance of ZnO films on ammonia was investigated. The maximum sensitivity 2.01 was recorded for ZnO nanorod- based sensor at 2200C for 140 ppm NH_3 exposure with a res/rec of 40s and 2.5 min respectively. The lowest detection limit was found to be 3.5 ppm of ammonia concentration.

Keywords: Ni-doped ZnO, Hydrothermal method, nanorods, gas sensor, ammonia.

ABICNAN201910061

Single Step Electrochemically Deposited Polydiphenylamine/CuO Nanohybrid Electrode for Methanol Electro-Oxidation Reaction

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Cost-effective non-noble metal oxide catalysts are of key significance to the successful use of direct methanol fuel cells (DMFC) for electricity generation. In this work, copper oxide nanoparticles (CuO-NPs) dispersed in polydiphenylamine (PDPA) matrix supported glassy carbon (GC) nanohybrid electrode were prepared using electrochemical deposition method. The physico-chemical characterizations were performed using X-ray diffraction studies (XRD), field emission scanning electron microscopy (FESEM) and UV-Visible spectroscopy. The electro catalytic activity of PDPA/CuO/GC modified electrode (ME) as anode catalyst towards methanol electro oxidation reaction in alkaline media was investigated by cyclic voltammetry (CV), Chronoamperometry(CA) and Electrochemical impedance spectroscopy (EIS). The fabricated electrode exhibits large surface area, reliable long term stability and more economical system to accomplish practical application in DMFCs.

Keywords: Polydiphenylamine, copper oxide, Glassy carbon electrode, Direct Methanol Fuel Cell.

ABICNAN201910063

Copper based Semiconductor Oxide Photocathodes for Photoelectrochemical Water Splitting

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In this study, we focus on Copper (Cu) based semiconductor photocathode nanomaterials such as Cu_2O, $CuBi_2O_4$, and $CuFeO_2$ for photoelectrochemical water splitting. The photocathode materials are prepared in the form of thin films by sol-gel followed by spin coating or dip coating or drop casting. All the proposed copper based oxide materials shows excellent optical absorbance in the visible range and the deduced bandgap values from Tauc's plot are 1.55 eV ($CuFeO_2$), 1.82 eV ($CuBi_2O_4$) and 2.18 eV (Cu_2O). XRD measurement reveals the crystalline nature of photocathodes. Photoelectrochemical properties and photostability performances are studied by linear sweep voltammetry (LSV), open circuit potential (OCP), Mott-Schottky plots and electrochemical impedance spectroscopy (EIS). This study provides new route to prepare materials using the sol-gel deposition and its influences in structural, optical and photoelectrochemical properties of photoelectrodes.

Keywords: Semiconductor, Delafossites, Sol-gel, Electrodeposition, Energy Conversion.

ABICNAN201910070

An Electrochemical Aptasensor for the Detection of MUC1 Based on Au-Pt Bimetallic Nanoparticles Decorated CGO/FTO as a Biosensing Platform

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A simple electrochemical strategy has been designed for the determination of MUC1 using electrodeposited gold platinum bimetallic nanoparticles (Au-PtBNPs) on the surface of carboxylated graphene oxide (CGO)/FTO electrode as a signal amplification platform. The carboxylic groups of CGO were activated with EDS-NHS linker and subsequently immobilized with streptavidin for further deposition of biotin labelled aptamer. All the modification steps were characterized by FE-SEM, FTIR and electrochemical methods. After incubating with target protein MUC1, the aptaelectrode produced some concentration dependent responses which were measured electrochemically by DPV assay. The prepared aptasensor exhibits wide linear range from 1 fM-100 nM with detection limit of 0.79 fM under optimal experimental conditions. The performance of this aptaelectrode was also evaluated showing good specificity and storage stability (15days). Furthermore, the applicability of the aptasensor was also applied for spiked serum samples with recovery range from 92% to 97%.

Keywords: MUC1, Electrochemical Aptasensor, Bimetallic Nanoparticles, Carboxylated Grapheme Oxide, Breast Cancer.

ABICNAN201910072

DC Sputter Deposited TiO_2 Thin Film on ITO/Glass Substrate for Perovskite Based Solar Cell Application

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A compact TiO_2 thin film which acts as electron transport layer (ETL) in pervoskite type solar cells is deposited onto ITO coated glass substrate using DC sputtering at room temperature followed by post annealing treatment at 450 °C for 2 hours. XRD pattern of TiO_2 coated ITO bilayer revealed the anatase phase of TiO_2 along with polycrystalline nature of cubic phase In_2O_3. Optical transmittance of TiO_2/ITO bilayer exhibited an average of 75% transmission of light. SEM images showed smooth, uniform and defect free thin film of TiO_2 on ITO substrate. Optimized TiO_2 thin film is obtained for device fabrication.
Keywords: TiO_2 thin film, DC Sputtering, TiO_2/ITO bilayer, Perovskite solar cell application.

ABICNAN201910074

A Facile Synthesis of Gold-Silver Nanoclusters For Fluorescence "Turn-Off" For Quinalphos And "Turn-On" For Cd^{2+} And Zn^{2+} Ions

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In this work, gold-silver bimetallic nanoclusters (Au-Ag NCs) were synthesized via one-pot synthetic approach using trypsin as a ligand. The synthesized bimetallic clusters have high intensity and show orange-red fluorescence under UV lamp at 365. The fluorescent Au-Ag NCs exhibit emission peak at 418 nm and 665 nm when excited at 350 nm.
Keywords: Au- Ag NCs, Trypsin, Quinalphos, Cd^{2+} ion, Zn^{2+} ion, UV-visible and Fluorescence spectroscopic techniques.

ABICNAN201910079

Comparative Study on Elastic Properties and Mode I Fracture Energy of Carbon Nanotube/Epoxy and Carbon Fibre/Epoxy Composite Laminates

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A comparative study has been performed to determine elastic properties and mode I fracture energy of conventional carbon fiber (CF)/epoxy and advanced carbon nanotube (CNT)/epoxy laminated composites for different CNT volume fractions. Three stacking sequences of composite laminates have been considered in the present finite element analysis of double cantilever beam specimens. It has been observed that with the addition of 15% CNT in epoxy gives almost the same value of longitudinal Young's modulus (*Ex*) and mode I fracture energy (*GI*) as compared to the addition of 60% CF in epoxy. The values of *Ex* and *GI* of CNT/epoxy

increased by 330.95% and 173.87%, respectively, compared to CF/epoxy for the same fiber volume fraction of 60%.

Keywords: Carbon nanotube, Carbon fibre, Finite element analysis, Elastic properties, Mode I fracture energy.

ABICNAN201910081

Nanoencapsulation of *Saccharomycopsis Fibuligera* VIT-Mn04 Using Electrospinning Technique for Easy Gastrointestinal Transit

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In the present study, probiotic yeast *Saccharomycopsis fibuligera* VIT-MN04 was encapsulated with cost effective materials viz. wheat bran fiber, exopolysaccharide along with 5% polyvinylpyrrolidone using electrospinning technique for easy GIT transit. The electrospinning materials viz. WBF (10%), EPS (15%), PVP (5%) and electrospinning parameters viz. applied voltage (10 kV) and tip to collector distance (15 cm) were optimized using response surface methodology to achieve maximum encapsulation efficiency (100%) and GIT tolerance (94%). The viability of encapsulated *S. fibuligera* VIT-MN04 could be retained at 4°C for 56 days. This is the first report on nanoencapsulation of probiotic yeast using electrospinning technique.

Keywords: Electrospinning, Nanoencapsulation, Probiotics, Wheat bran fiber, Yeast

ABICNAN201910082

Nanotechnological Approach to Improve the Thermal, Mechanical, Biodegradable and Biocompatible Properties of Polyhydroxyalkanoates (Pha) Copolymer for Food Packaging: Formulation of Biogenic Pha/Bsnps Bionanocomposites

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Polyhydroxyalkanoates (PHAs) are 100% biodegradable polymers having a wide range of applications. Despite of the promising commercial potential, PHAs have been reported to exhibit low thermal and mechanical strength. In the present study, biogenic silica nanoparticles (bSNPs) was synthesized and characterized. The bSNPs were reinforced into P(3HB-co-3HV) to formulate P(3HB-co-3HV)/bSNPs bionanocomposites via solution casting technique. The changes in the morphology, degradation, thermal and mechanical strength of P(3HB-co-3HV) and P(3HB-co-3HV)/SiO2 bionanocomposites were analyzed by SEM, TGA-DSC and tensile analysis. The cytotoxicity of bSNPs, PHA and PHA/bSNPs were studied by MTT assay and by assessing cellular morphological changes in normal human cells.

Keywords: Biogenic Silica nanoparticles (bSNPs), P(3HB-co-3HV)/bSNPs bionanocomposites, Tensile strength, Biodegradability, Biocompatibility

ABICNAN201910084

Antibacterial Activity Study of Ag-ZnO Nanoflowers Synthesized from Neem Extract

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Zinc oxide has gained tremendous attention for its wide applications. A few green synthetic methods have been reported on ZnO (ZO) / metal doped ZnO with hierarchical structure for antimicrobial activity study. In this work, a green synthesis of flowerlike nano Ag-ZnO (AZO) from neem extract (*Azadiracta indica*) has been performed by solution method. The material properties such as crystal phase, morphology and optical property as well as the effect of AZO on the growth of *S. aureus* and *E. coli* bacteria have been investigated. A high efficacy on the growth inhibition under visible light is observed in AZO nanoflowers.
Keywords: Green synthesis**,** Ag-ZnO nanoflowers, Antibacterial activity.

ABICNAN201910092

Phase Stability of $ZnCo_2O_4$ Nanostructures and their Magnetic Properties

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We report the structural and magnetic properties of various sizes of $ZnCo_2O_4$ nanostructures grown by sol-gel process. This compound crystallizes into cubic spinel lattice (*a*o ~ 8.089Å) with space group *Fd*3*m* for all the calcination temperatures below 700°C in air. However, any thermal heat treatment beyond 600°C destabilizes the spinel lattice and leads to phase segregation. The temperature dependence of magnetization M(*T*) measurements of $ZnCo_2O_4$ nanostructures do not show any transition below 300 K and exhibits (super)paramagnetic behaviour with reversible zero-field-cooled and field-cooled M(*T*) curves. On the other hand, the samples heat-treated at 1200°C for 4h in air exhibit antiferromagnetic behaviour.
Keywords: Spinels, Superparamagnetism, Antiferromagnetism, and Sol-gel process.

ABICNAN201910095

Hydrothermally Synthesized Coral Shaped $NiSe_2$ Nanoparticles: As an Efficient Cathode for Hydrogen Evolution Reaction

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Here, Nickel diselenide ($NiSe_2$) is synthesized hydrothermally in one step varying the reaction time. Important characterizations are performed to determine its phase, morphology etc. XRD spectra confirms about correct formation of the $NiSe_2$ nanoparticle besides coral structure of particle is visualized from FESEM. After synthesis, $NiSe_2$ particles are utilized as negative electrode in three electrode system which catalyses the water splitting reaction forming hydrogen at $NiSe_2$ electrode. Among three different synthesis variations, $NiSe_2$ 24 has shown best electrocatalytic activity in hydrogen evolution.

Keywords: Hydrothermal, coral, HER.

ABICNAN201910096

First-Principles Density Functional Theory (DFT) Study of Ge Diluted Cobalt Orthotitanate

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We report the role of Ge substitution on the tetragonal distortion in $TiCo_2O_4$. The cationic disorder plays an important on the entropy and configurational free energy. As the Ge dilution increases Ge atoms occupies mostly Octahedral B sites. The density of states calculation provides evidence for stable ferrimagnetic structure in $Co_2Ti_{0.875}Ge_{0.125}O_4$. The top of the valence band was mainly populated by the t_{2g} states of octahedral Co, whereas the $e_g$states are situated deep inside the valence band. The t_{2g} states of octahedral Ti occupy the conduction band minima.

Keywords: Spinels, VASP, density-functional theory, Néel temperature and ferrimagnetism.

ABICNAN201910097

Influence of Solvent on Morphological Texture And Catalytic Activity Of SnO_2 Nanomaterials

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Tin dioxide (SnO_2) nanomaterials are prepared by a simple template free solvothermal route in the presence of two different solvent viz. ethanol and ethylene glycol. The as prepared SnO_2 are well characterized and the influence of solvent on the synthesis of the nanomaterials is studied. In presence of ethanol SnO_2 nanoparticles are formed whereas starfish like nanostructures of SnO_2 are obtained in presence of ethylene glycol. Further, the as prepared SnO_2 nanomaterials are employed in Friedel-Crafts acylation of aromatic compounds. The starfish like SnO_2 nanostructures shows higher catalytic activity compared to SnO_2 nanoparticles with good recyclability upto four consecutive cycles.

Keywords: Nanomaterials, Solvothermal, Acylation, Recyclability.

ABICNAN2019100101

Electrochemical Studies on Ni, Co & Ni/Co/MOF for High Performance Hybrid Supercapacitors

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Metal organic frameworks (MOF) of Ni, Co and Ni/Co were synthesized by a facile hydrothermal method. The physico-chemical properties of these MOF were characterized by P-XRD, BET surface area, SEM-EDS, TEM, FT-IR techniques. The supercapacitance performance of these MOF were studied by electroanalytical techniques such as cyclic voltammetry (CV), chronopotentiometry (CP), Electrochemical impedance spectroscopy (EIS). Ni/Co/MOF exhibited higher specific capacitance than other MOFs by CV- 2041 F/g (2mV/s), CP- 980 F/g (2.5A/g) and delivered maximum energy density of 57.5 Wh/kg at power density of 1.015 KW/kg. A correlation between the electrochemical performance and the physico-chemical properties were studied in detail.
Keywords: Hybrid supercapacitors, Metal organic frameworks (MOF), Hydrothermal.

ABICNAN2019100103

Development of ZnO - Chitosan Nanoreactor for the Treatment of Textile Industrial Effluent

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Zinc oxide/chitosan biocompatible nanoreactors have been successfully synthesized by co-precipitation method. The samples were characterized by X-ray diffraction (XRD), Scanning electron microscope (SEM), Energy dispersive X ray Flurescence spectroscopy (EDAX) and Fourier transformation infrared spectroscopy (FTIR).The photocatalytic efficiency and photostability of the sample was investigated systematically for Congo red degradation under solar light irradiation. UV-vis Spectroscopy was employed to investigate the optical properties and photocatalysis behavior of the Zinc oxide/Chitosan nanoreactors. It was shown that zinc oxide/chitosan biocompatible nanoreactors could drive to a plausible strategy for developing finest photocatalyst to degrade wastewaters by using solar light.
Keywords: Congo red, Zinc oxide/Chitosan conjugate, photocatalysis, photo degradation, Nanoreactor

ABICNAN2019100105

Electric Field Induced Instability of Liquid Crystal-Polymer Interface

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Electric field induced instability at the polymer/air or polymer/polymer interface has been extensively studied over the decades due to its potential application in soft lithography. The process involves competition mainly between stabilizing surface tension of the concerned polymeric thin film and the destabilizing electrostatic pressure. With the ramping of voltage,

perturbation for a particular wavelength grows with time and forms microstructures with a specific length-scale.

Here, a parametric study is presented, highlighting the effect of viscoelastic film thickness on the wavelength (λ) of formed microstructures at a constant DC electric field. We study the opto-electric properties of the top liquid crystal layer of a polymer-liquid crystal confined bilayer induced by electrohydrodynamic instability. Depending on the dielectric contrast and ratio of two film thicknesses, hexagonal closed packed (HCP) ordered holes can be formed when the dielectric constants of the upper layer is higher. The distinct formation of holes results from the nonlinear interactions among different modes and, hence, is governed by the kinetics. The structures of holes continue to generate minimizing the system's free energy. During this process, stepping up the voltage further results coalesce of individual holes in a coarsening process until a thermodynamically stable state is reached in the form of localized holes.

Keywords: Electric field, Bilayer instability, Liquid crystal, Patterning.

ABICNAN2019100107

Scanning Electrochemical Microscopic Imaging of Electrochemically Polymerized 4-Chloroaniline and Its Application as a Ph Sensor

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Analyzing electroactive surface-feature of conducting polymer by analytical technique is a cutting-edge technique in material science research. In this work, feedback mode Scanning Electrochemical Microscopic (SECM) technique was utilized for exploration of the electrochemical polymerization of 4-chloroaniline (4-CA) to poly(4-chloroaniline) (Cl- PANI) over graphitized mesoporous carbon (GMC) modified glassy carbon electrode (GCE) in physiological pH. The polymerized electrode was found to give a stable redox peak in pH 7 phosphate buffer solution (PBS). Physicochemical characterizations such as FT-IR, Raman, TEM, FE-SEM were analyzed for the modified electrode which added evidence for the successful polymerization of 4-chloroaniline. The GMC@Cl-PANI modified electrode showed a sensitive and selective pH monitoring of real samples such as saliva and urine. As an extended application of the electropolymerized 4-chloroaniline, the modified electrode was exposed to the bacterial (E-coli) growth for pH monitoring, which revealed a comparable response with the conventional pH electrode.

Key words: Scanning electrochemical microscopy; 4-chloroaniline (4-CA); electropolymerization; pH sensor

ABICNAN2019100108

Solution Processed Copper Oxide as Hole Transport Layer for Efficient Organic Solar Cell

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Oxides of copper with two stable phases, namely CuO and Cu_2O have interesting optoelectronic properties which include optical bandgap in the visible wavelength range (2.1 eV for Cu_2O and 1.9 eV for CuO) and high carrier mobility (□10-3-100 cm2/Vs).Here we study the feasibility of solution processed Cu_2O thin film as hole transport material in organic solar cell. Thin films of Cu_2O were characterized by UV-Vis spectroscopy and SEM-EDX analysis. Solar cell devices were fabricated with Cu_2O as buffer layer and standard IV measurements were carried out and compared with reference devices (with PEDOT:PSS as buffer layer) and comparable performances was achieved.

Keywords: Cu_2O, sol gel, Solution-process, Hole transport layer, Organic solar cell

ABICNAN2019100109

Morphology Tuning of Bismuth Oxychloride Nano-Crystals by Citric Acid Variation: Application in Visible Light Assisted Dye Degradation

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Among the different reported oxyhalides, Bismuth Oxychloride (BiOCl) is a p-type indirect band gap semiconductor with band gaps lying in the range of 3.2 ~ 3.5 eV. In this work, variation in the capping agent citric acid used during synthesis of BiOCl was performed in order to tune the morphology of the as-synthesized samples. The samples were characterized in details for insight into phase formation, chemical composition etc. Finally the as-synthesized samples were utilised for effective degradation of toxic textile dyes like Rhodamine B.

Keywords: Bismuth oxychloride, Citric acid, Photocatalysis, Textile dye.

ABICNAN2019100116

Impact of Ion Implantation on Cadmium Telluride Thin Films Synthesized by Thermal Evaporation Method

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This work presents the effect of low-energy ion beam on cadmium telluride (CdTe) thin films. CdTe thin films of thickness 200 nm were deposited on glass substrates using thermal vacuum evaporation (TVE) method and then annealed at 200ºC for 40 min. The structural, morphological, optical and electrical properties of as-deposited and annealed films were investigated using XRD, SEM, AFM, UV-Visible Spectrophotometer and two-probe set up respectively. The annealed films were found to be more crystalline and conductive in nature as compared to pristine one. The Optical studies revealed the reduction of optical band gap from 1.58 eV to 1.50 eV. The effects of low-energy ion beam are also investigated on CdTe films.

Keywords: Thermal vacuum evaporation, Thin films, Structural analysis, Morphological analysis, Optical analysis.

ABICNAN2019100117

Hydrothermal Synthesis of Manganese Oxide Nanoparticles for Photocatalytic Hydrogen Production

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Manganese oxide (Mn_2O_3) nanoparticles were synthesized by hydrothermal method. As-synthesized- γ MnOOH were calcined 600 °C to obtain Mn_2O_3 nanoparticles which were further subjected to various characterizations. The bixbyite cubic phase formation of Mn_2O_3 was confirmed by XRD results. The surface morphology was investigated by SEM. The chemical composition and elemental analysis were confirmed by FTIR and EDX studies, respectively. Bandgap of the material was estimated from the UV–vis absorption. Effective involvement of Mn_2O_3 as catalyst was investigated on photo catalysts for the water oxidation process.
Keywords: Hydrothermal method, Energy Storage, Mn_2O_3, Optical properties.

ABICNAN2019100118

Effect of Trivalent (M^{3+}: M=Eu, Cr) Substitution in Ceria for Supercapacitor Application

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Ceria and its Eu ($Ce_{0.9}Eu_{0.1}O_2$) and Cr-based ($Ce_{0.9}Cr_{0.1}O_2$) derivatives are studied for supercapacitor-electrode applications. $Ce_{0.9}Cr_{0.1}O_2$ exhibits the maximum specific capacitance of 272 F g-1; which is ~258% improvement over CeO_2, and ~3.3% better than $Ce_{0.9}Eu_{0.1}O_2$. $Ce_{0.9}Eu_{0.1}O_2$ exhibits best rate capability compared to the other samples, as it retains ~50% of its maximum specific capacitance even at 10 A g-1 current density. A Swagelok cell consisting $Ce_{0.9}Cr_{0.1}O_2$@Ni-foam shows ~78% capacitance retention even after 10000 cycles. Overall, the study indicates that the derivatives offer decent enhancement of specific capacitance, rate capability, and cycle life for supercapacitors over ceria.
Keyword: bimetallic system, metal oxide, supercapacitor, electrode, ceria.

ABICNAN2019100120

One Dimensional Nanostructured Oxygen Deficient Vanadium Oxide: Synthesis and Characterization

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Nanostructured crystalline mixed valance vanadium oxide in the form of nanotubes and nanobelts were chemically assembled via rapid thermal decomposition of vanadium oxide precursor achieved by microwave-assisted method. The nanostructures were characterized by

X-ray powder diffraction (XRD) measurement, field emission microscopy (FESEM), transmission electron microscopy (TEM), X ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy (RS), and thermo gravimetric analysis (TGA). Growth mechanism of nanostructured mixed vanadium oxide has been proposed on the basis of crystallographic structure. The synthesized nanostructured vanadium oxides are oxygen deficient. These oxygen deficient oxides are suitable for future applications.
Keywords: Vanadium Oxide nanostructure, Microwave synthesis, XRD, Raman spectroscopy, XPS.

ABICNAN2019100123

A Detailed Perceptive on the Synthesis and Application of pH Responsive Oil Sorbers via LRP Technique

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Well-defined oil-absorption material was successfully synthesized *via* living radical polymerization (LRP) on the surface of poly lauryl methacrylate utilizing hydrophilic groups as monomers, Copper(0)/pentamethyldiethylenetriamine as catalyst system. The polymerization proceeded in a ‘‘living’’ polymerization manner as indicated by linearity kinetic plot of the polymerization. Plots of ln([M])0/([M]) versus time and plots of the molecular weight versus conversion showed a linear dependence, indicating a constant number of propagating species throughout the polymerization. The chemical structure of sorbent was determined by FTIR spectrometry and in addition TGA, GPC and ^{1}H NMR provide additional evidence for the formation of the block copolymer. The oil-absorption sorber shows a higher absorption capacity especially for trichloroethylene compared to other organic solvents. The sorber also possesses a thermoresponsive behavior at both 25 ˚C and 55 ˚C.
Keywords*:* Oil sorbers, Amphiphilic copolymers, Living radical polymerization, Super adsorbent, thermoresponsive polymers.

ABICNAN2019100125

Codeposition of Electroless Ni-P/ZnO Nano Composites on Copper Substrate and Evaluation of Corrosion Resistance of the Coatings

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Codeposition of nano ZnO with Ni-P coatings was carried out on copper substrates. The process optimization of carried out by varying the composition of nano ZnO particles using ultrasonicator. An adherent and uniform coating of Ni-P/ZnO was obtained. Presence of ZnO in the coatings was confirmed by EDAX. Surface morphology of the coatings was studied by SEM which shows the smooth homogenous surface in Ni-P/ZnO composite coating. Corrosion resistance of the coatings was evaluated by Salt spray test and Galvanostatic Polarization method using 5% NaCl solution. Corrosion resistance of the Ni-P and Ni-P/ZnO composite coatings were compared. Incorporation of nano ZnO in the coatings found to enhance the corrosion resistance and microhardness of the coatings.
Keywords: Codeposition; Electroless; Nano ZnO; Polarization; Salt Spray test.

ABICNAN2019100126

Recovery of Silica Nanoparticles from Waste PV Modules

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Recycling of PV modules to recover raw materials is much needed in current scenario. In this work, silica nanoparticles are recovered from discarded PV modules using chemical and thermal treatment. I-V characteristics are performed to determine the type of doping on the front and back surface of silicon wafer. XRD characterisation is performed to find the orientation of recovered silicon. Further silica nanoparticles is synthesised from silicon wafer and result obtained is in agreement with UV-vis spectrophotometry. This work will set new pathways for developing a PV module waste management industry which enhances the supply of future raw material requirement.

Keywords: PV module, EVA.

ABICNAN2019100127

Cobalt-Free $Li[Li_{0.2}Ni_{0.2}Mn_{0.6}]O_2$ Layered Cathode For Lithium-Ion Battery Applications

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Layered $Li[Li_{0.2}Ni_{0.2}Mn_{0.6}]O_2$ nanoparticles can be considered as an eminent cathode material for LIB applications. Herein, we report sol-gel synthesized nanoparticles that has an average particle size of about 50 nm. It exhibited a first cycle discharge capacity of about 180 mAh/g at a current density of 125 mA/g (~C/2) and 124 mAh/g at a high current density of 1 A/g (~4C). Cycling stability of 250 cycles with only 0.18% capacity loss per cycle and a Coulombic efficiency of 99.6%. Importantly, first cycle Coulombic efficiency was 84.8% which is typically a high value for Li-excess materials reported in the literature. The as-prepared cobalt-free, Li-excess shows potential to be investigated and possible nano-engineering to improve their electrochemical performances further.

Keywords: Layered Li-excess transition metal oxide, Cathode, Li-ion battery.

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Radiative 3D- MHD Flow of an Aqueous Ethylene Glyco Nanouid Past a Two-Way Exponentially Extending Lamina

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An analysis has been carried out for the radiative MHD ow of an aqueous ethylene glycol nanouid past two way exponentially extending lamina. Appropriate transformation is used to reduce the nonlinear partial differential system to an ordinary differential system. The resulting nonlinear ordinary differential system is solved numerically using fourth order Runge Kutta

shooting method for the satisfaction of asymptotic boundary condition. The velocity and temperature sketches of copper and alumina in aqueous ethylene glycol (a-EG) nanouid for the present physical stratum are obtained and displayed graphically by _xing various values for perti- nent factors of the problem namely , velocity ratio factor(λ), magnetic interaction factor (M), nanoparticle volume fraction(), exponential coe_cient factor(A) and temperature-radiation factor Rd, _xing the Prandtl number of the core uid(a-EG) constant at 25:825 skin friction coefiient and rate of heat transfer for various fac-tors of the problem are tabulated and compared with the existing results in the literature. Numerical simulation with comparisons are also provided to demonstrate the e_ectiveness of the obtained results.

Keywords : Thermal Radiation, 3D-MHD Flow, Two way Exponential Extending Lamina, Aqueous Ethylene Glycol, Runge Kutta Shooting Technique.

ABICNAN2019100130

Effect of Sonication and Ball Milling Time on the Morphology of Multiwall Carbon Nanotubes

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Carbon nanotubes (CNTs) have shown promising potential for application in many engineering fields owing to their astonishing properties but the problems of CNT aggregation has been a major barrier hampering their application in various fields especially in nanocomposites industry. For the fabrication of nanocomposites with better properties, it is necessary to develop a uniformly dispersed stable solution of CNTs in various solvents. In the present investigation, the stability analysis of the multi-walled nanotubes (MWCNTs) solution dispersed by sonication in various solvents were analysed by using photographic images. Further, the effect of sonication and ball milling on the MWCNTs length and morphology were also analysed by using Scanning Electron Microscop (SEM) and Transmission Electron Microscopy (TEM). After In-depth investigation, it has been observed that the type of solvents and dispersion time is a critical factor which strongly affects the stability and morphology of the CNTs.

Keywords: Carbon nanotubes; dispersion; sonication; ball milling.

ABICNAN2019100131

Effect of CTAB Concentration on the Properties of NiO Nanoparticles Prepared by Hydrothermal Method

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Nickel oxide (NiO) nanoparticles were prepared with the various concentration of cetyltrimethylammonium bromide (CTAB) by using hydrothermal process. The NiO nanoparticles were characterized by X-ray (XRD), UV-visible spectroscopy (UV-Vis), Scanning electron microscopy (SEM) and Cyclic voltammetry (CV). The effect of concentration on NiO nanoparticles leads to more significantly change its size and properties,

particularly in its electrochemical properties which show the ways to be the suitable candidates for supercapacitor, battery, photo catalytic and fuel cell applications.
Keywords: CTAB, Ni-O, Electrochemical, Fuel Cell.

ABICNAN2019100132

Growth and Characterization of Superconducting YBCO Thin Film by Pulsed Laser Deposition Technique

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Present work focused on pulsed laser deposition (PLD) system, fabrication of high temperature superconducting YBCO thin films and their characterization. For the synthesis of YBCO composite target sample, we have used precursor salts were Y_2O_3, $BaCO_3$ and CuO and mixed in the ratio of Y: Ba: Cu = 1:2:3 respectively. XRD has confirmed the polycrystalline growth with orthorhombic phase of YBCO target whereas cubic phase for MgO and STO substrates. The SEM observations revealed uniform distribution of spherical particles on the surface morphology of YBCO target sample. Presence of all desired elements confirms by EDAX spectrum.
Keywords: Superconducting, PLD, Thin film, XRD.

ABICNAN2019100133

Calotropis Procera- Phytochemical MWCNT Chemically Modified Electrode for Electroanalytical Applications of Hydrazine

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Calotropis Procera (C.Procera) is itself a unique plant with different common names like Apple of Sodom, Rubber bush, French cotton etc. It belongs to family Apocynaceae. It is popular for its medicinal and toxic properties both of which taken into consideration equally. There are plenty of literatures related to latex of Calotropis Procera but all about phytochemical studies. Here is the effort done first time to immobilize the crude latex sample with the multiwalled carbon nanotube on to the glassy carbon electrode and labeled as GCE/MWCNT@LA with a fixed potential of 0.1 to 0.3V. Utilizing above system successfully sensed our analyte Hydrazine for electrolytic applications in pH-7 Phosphate Buffer solution. And that to different four types of solvents like Ether, Methanol, Acetone, Ethanol are used along with Amperometric response was observed and various analyte interferences are also checked. The sample with acetone we taken as ideal one and checked TLC, performed column observed 1H and 13C signal of NMR, UV, IR, GC-MS. After preparation of highly redox active GCE/MWCNT@LA modified electrode it can be used various for electroanalytical application.
Keywords: GCE/MWCNT@LA, C.Procera.

ABICNAN2019100134

Determination of Mechanical Properties for Cubic Phase of Titanium Dioxide

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First principle calculations of all mechanical properties for cubic TiO_2 have been carried out with the Orthogonalized linear combination of atomic orbitals (OLCAO) with generalized gradient approximation (GGA) in the scheme of Perdew-Burke-Ernzerhof Solid (PBES) as exchange-correlation. We calculated elastic constants for fluorite and pyrite structure. And using these elastic constant, all mechanical properties such as bulk, shear and young modulus, Vickers hardness, poisons ratio have been investigated and obtained values are similitude with preveous available data and values are in good agreement with other researchers.
Keywords: density functional theory, cubic TiO_2, mechanical properties.

ABICNAN2019100136

Synthesis and Applications of Transition Metal Mixed Oxide Doped Graphene Embedded Durable Electrocatalyst for Hydrogen Evolution Reactions

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Electrochemical water splitting reaction plays a vital role in designing of high energy devices. In this work we have prepared transition metal mixed oxide (Iron – Titanium –Graphene oxide) composite (FTG) by thermal decomposition method and it coated over substrates through electroless bath process. Electrochemical measurement results indicates that the prepared electrocatalyst Ni-P, Ni-Co-P, Ni-Co-P/FTG exhibit enhanced electrocatalytic activity for hydrogen evolution reactions (HERs) with lower overpotentials in alkaline media. The decreased diameter of semicircles in Nyquist plots depicts the stability and controlled reaction kinetics (Volmer – Heyrovsky) of catalysts. The EIS analysis also indicate the superior performance of electrocatalysts under dynamic experimental conditions.
Keywords: Graphene oxide, Hydrogen evolution, Electrocatalyst, Ni-P, Water Splitting

ABICNAN2019100137

Luminescence Properties of Nano and Bulk $ZnWO_4:Eu^{3+}$ Phosphors for Solid State Lighting Applications

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Eu^{3+} doped $ZnWO_4$ phosphors were developed by solid-state reaction and hydrothermal reaction methods and their optical properties were investigated with respect to the dimension. The photoluminescence (PL) emission, excited state lifetime of the nanophosphor exhibits better performance than its bulk counterpart under 283 nm optical excitation. The

nanophosphors display homogeneous particles with much smaller dimension compared to the bulk phosphors which is the reason behind the enhancement in nanophosphors' intense red emission compared to the bulk. Moreover, the thermal stability of the nanophosphor is much better than the bulk phosphor, which clearly indicates a key advantage of nanophosphor.
Keywords: bulk phosphor, nanophosphor, photoluminescence (PL) emission, solid-state lighting (SSL), solid state reaction.

ABICNAN2019100140

Graphene Embedded Silane Grafted Hydro Talcite Clays as An Efficient Adsorbent for The Removal of As(V) From Aqueous Systems

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In the present work a novel adsorbent Reduced graphene oxide embedded tetra ethyl ortho silicate grafted Hydrotalcite clay composite (TEOS-g-HTS/rGO) was prepared via emulsion polymerisation technique and its performance for the removal of As(V) from aqueous media was investigated. The material was well characterized by FTIR, XRD, TG/DTG, SEM-EDS, HRTEM, XPS, Raman and DLS Zeta potential analysis. The more favourable adsorption kinetics was identified by using non-linear kinetic models with least $\chi 2$ values. The maximum loading capacity, Q0 was found to be 147 mg/g using different isotherm experiments. The thermodynamics and kinetics study were performed and the parameters were evaluated.
Key words: Adsorption isotherms, As(V) removal, Adsorption kinetics.

ABICNAN2019100143

Dipole Relaxation Behaviour and Dynamical Response of Zn Substituted $CuFe_2O_4$: Role of Polar Nanoregions

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Cuprospinel ($CuFe_2O_4$) is known to have lower symmetry than cubic below a critical temperature ~ 360°C due to the cooperative Jahn-Teller Distortion. This system contains mixed spinel structure with different cationic distribution $(Cu_{\eta}Fe_{1-\eta})_A[Cu_{1-\eta}Fe_{1+\eta}]_BO_4$ (η~0.04) which depends on the preparation methods and heat-treatment conditions. In the present work we report low-loss (Tan $\delta < 4$) and giant dielectric permittivity (ε_r >5×103) of Zn substituted $CuFe_2O_4$. The frequency response of ac-conductivity $\sigma_{ac}(f)$ follows the Jonscher's power law relation $\sigma_{ac} = \sigma_{dc} + A\omega^{`}$ ($0 < s < 2$). The temperature ($80K \leq T \leq 320K$) and frequency ($20Hz \leq f \leq 1MHz$) dependence of dielectric permittivity ($\varepsilon_r(T)$) and loss-Tangent (Tan δ (T)) exhibits systematic changes in their peak positions which are consistent with the dipole relaxation mechanism involving significant amount of polar nanoregions.
Keywords: Cuprospinel, Dielectric Relaxation, Polar Nanoregions and Jonscher's power law.

ABICNAN2019100144

In situ Functionalized Microtip Pencil Graphite Electrode as a Versatile Tool for the Sensitive Detection of Dopamine.

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Trace level dopamine detection in the absence of interference such as ascorbic acid is quite challenging. Pencil graphite electrode is unavoidable in such case, it holds the scope for more real time application. Herein, we introduce 0.7mm micro tip pencil graphite named (0.7mm PGE*) prepared by pre-anodization process at 1.2V vs Ag/AgCl in pH7 PBS. It shows a good oxidation current response towards dopamine detection using optimized differential pulse voltammetry condition.

Keywords: Pencil graphite electrode, Neurotransmitters, Anodization, Portable device

ABICNAN2019100146

Electrocatalytic Oxidation of Methanol by High-valent Ru(IV) Complex Stabilized Mesoporous Carbon Modified Electrode

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A highly redox active and stable electrochemical immobilization of high-valent $[Ru^{IV}(terpy)(O)(OH)]^{+}$complex on GMC modified glassy carbon electrode was reported. The modified electrode showed a distinct electron-transfer reaction with standard potential of $E^{\circ\prime}$ = 0.88V vs Ag/AgClin pH 7 PBS. The immobilized Ru-complex on the modified electrode surface is characterized by performing various physicochemical characterizations using TEM, Raman, IR, and UV–vis spectroscopy and ESI-MS as the $[Ru^{IV}(terpy)(O)(OH)]^{+}$ complex. Amperometric i–t based electrochemical oxidation of methanol showed a current linearity in the concentration window 50.0– 350 mMwithdetection and sensitivity were found to be 18 □M and 0.0278μAμM^{-1}, respectively. The oxidation of the Ru^{III}–OH to the Ru^{IV}=O state is accompanied by the 2-electron oxidation of the coordinated methanol ligand yielding formaldehyde.The resulting modified electrodeshowed a good reproducible electrochemical behavior, long stability, and excellent catalytic activity for methanol oxidation. Finally, the present work can be taken into consideration in the design of more effective bioinspiredelectrocatalyticelectrode, capable of performing the oxidation of methanol under mild conditions.

ABICNAN2019100150

An Insight Into The Superior Performance Of ZnO@Peg Nanocatalyst For The Synthesis of 1,4- Dihydropyrano[2,3-C]Pyrazoles Under Ultrasound

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The investigation presents a straightforward synthesis of fifteen 1,4-dihydropyrano[2,3-c]pyrazoles using ZnO@PEG nanocatalyst in ethanol *via* Multicomponent approach under the influence of ultrasound. The present methodology successively tolerates a variety of functional groups and offers several advantages such as excellent yields without chromatographic purification, milder reaction conditions, shorter reaction times and the use of an environmentally benign reusable catalyst. Ecstatically, the reaction was successfully scaled to gram level ascertaining the wider applicability of ZnO@PEG nanoparticles in multicomponent reactions.

Keywords: ZnO@PEG nanoparticles, ultrasonic irradiation, 1,4-dihydropyrano[2,3- c]pyrazol-6-amines, four component synthesis, Multicomponent reaction.

ABICNAN2019100151

Nano NiO-An Efficient and a Reusable Catalyst for the One Pot Synthesis of Novel Tetrahydropyridine-3- Carboxylates Under Sonication

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An elegant, atom efficient protocol for the synthesis of a series of pharmacologically interesting polysubstituted tetrahydropyridine-3-carboxylates has been developed *via* a one-pot four-component cyclocondensation reaction of Meldrum's acid, arylaldehydes, aromatic amines and ethyl cyanoacetate catalyzed by NiO nanoparticles in ethanol under ultrasound irradiation. In comparison with the reported methods, our approach is convenient and offers several benefits such as milder reaction conditions, shorter reaction time, excellent yields, use of reusable catalyst and is environmentally benign. We have herein demonstrated a successful conjuction of NiO nanoparticles and sonication in the synthesis of tetrahydropyridine-3- carboxylates by multicomponent approach.

Keywords: NiO nanoparticles, ultrasonic irradiation, tetrahydropyridine-3-carboxylates, One-pot synthesis, Multicomponent reaction;

ABICNAN2019100152

Fabrication of Superhydrophobic Surface by Chemical Etching on Al Substract with Self-Cleaning, Durability and Corrosion Resistant

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In this work, a mixture of $CuCl_2$/HCl in distilled water was used to create the microstructure on the aluminium surfaces after chemical etching and followed by low surface energy material. In addition, the two step process was used. SEM was used to analysis the rough micro structured on its surface. It showed the self-cleaning properties towards the all liquids based products. It has robust durability with UV-resistant properties. The modified sample showed the corrosion resistance ability compared to uncoated samples. Thus, it can be used for the multifunctional purposes.

Keywords: Superhydrophobic, corrosion resistant, chemical etching, mechanical durability.

ABICNAN2019100154

$Er^{3+}/Tm^{3+}/Yb^{3+}$: $Gd_2(Mo0_4)_3$ Upconverting Nanophosphors for White Light Emission

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Structural and optical properties of the Tm^{3+}, Er^{3+}, Yb^{3+}: $Gd_2(Mo0_4)_3$ nanophosphors have been studied. The upconversion spectra of the Tm^{3+}- Er^{3+}- Yb^{3+}: $Gd_2(Mo0_4)_3$ nanophosphors shows bands peaking around ~ 474 nm, ~ 530 nm, ~ 546 nm, ~ 551 nm and ~ 797 nm due to the transition $^1G_4 \rightarrow {}^3H_6$, $^2H_{11/2} \rightarrow {}^4I1_{15/2}$, $^4S_{3/2} \rightarrow {}^4I_{15/2}$, $^4F_{9/2} \rightarrow {}^4I_{15/2}$, and $^3H_4 \rightarrow {}^3H_6$ respectively for the blue, green, red and NIR region. Structural study shows that the particles are in the nanometer range. The CIE diagram shows that the colour emitted by the developed material is in the near white region.

Keywords: Luminescence, Rare earth ions, X-ray diffraction, Light emission device.

ABICNAN2019100155

Structural, Optical and Electrical Properties of $BiFeO_3$ Based Nanocomposite Hybrids of Graphene and Multiwall Carbon Nano Tube

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Single phase nanopowder of Bismuth ferrite has been achieved without any secondary phases using conventional sol gel process. The unit cell character and the average crystallite size of the rhombohedral particles were appeared by recording powder X-ray diffraction. Subsequently, nanocomposite of bismuth ferrite has been formed with graphene and multiwall carbon nano tube (MWCNT).The complex formation was also ascertained through XRD. Its optical and electrical characteristics to the possible use for super capacitor application are under progress.

Keywords: XRD, Solgel method, Graphene, CNT, nanoparticles.

ABICNAN2019100156

Synthesis, Characterization and Photocatalytic Activity of SnO_2, ZnO Nanoparticles against Congo Red: A Comparative Study

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SnO_2, ZnO nanoparticles were successfully synthesised by simple solution route via environmental friendly approach using *Simarouba Glauca* leaf extract as biosolvent. The products were characterized by XRD, FTIR, UV, SEM-EDAX and TEM. The photocatalytic activities of the as-prepared SnO_2, ZnO nanoparticles were evaluated by degradation of Congo Red, a common textile, under sunlight.

Keywords: SnO_2, ZnO, Green synthesis, Simarouba Glauca, Congo Red.

ABICNAN2019100157

Antibacterial and Anticancer Activity of Biosynthesised CuO Nanoparticles

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The present investigation aims at the synthesis of copper oxide nano particles (CuO NPs) using Nilgirianthusciliatus plant extract .Nanoparticle of CuO were synthesized by mixing copper sulphate dehydrate ($CuSO_4$ .5 H_2O) and Nilgirianthusciliatus leaf extract.The obtained copper oxide nanoparticle were characterized by XRD, FTIR , UV –Vis ,SEM and TEM analysis .Significant bacterial activity was manifested by CuO nanoparticles against both gram positive (S .aures and S .mutans) and gram negative (E .Coli and P.aeuriginosa) bacteria. The synthesized CuO NPs have good cytotoxicity against cancer cell lines like human breast (MCF -7)and minimum cytotoxic effect on normal human dermal fibroblast (NHDF) cell lines .
Keywords: Green Synthesis, CuO NPs, Nilgirianthusciliatus, antibacterial and anticancer activity.

ABICNAN2019100158

Facile Synthesis of PANI-MWCNT-Ni(OH)$_2$ Ternary Composites And Study Of Their Performance As Electrode Materials For Supercapacitors

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Supercapacitors are energy storage devices with characteristics intermediate of that of batteries and capacitors. Polyaniline-multiwalled carbon nanotubes-nickel hydroxide composites (PANI-MWCNTs-Ni(OH)$_2$) with wt% 25:5:70 were prepared by a two stage procedure involving interfacial polymerization and hydrothermal method at two temperatures, 120^{0}C and 180^{0}C. The composites were characterized by different spectroscopic and microscopic techniques. Electrochemical capacitive performances were explored using different electrochemical methods. PANI-MWCNT-Ni(OH)$_2$(120^{0}C) exhibited a slightly higher specific capacitance of 1917 F/g at a scan rate of 2.5 mV/s in 1M KOH under a potential window of 0-0.6V. Furthermore, this composite showed better percentage retention and cycle stability.
Keywords: Polyaniline, Nickel hydroxide, carbon nanotubes, supercapacitors, electrochemical studies

ABICNAN2019100159

Removal of Lead (Li) Ions from Water Using Copper Ferrite Nanoparticles Synthesized by Green Method

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The present work describes the removal of lead by adsorption on Copper Ferrite nanoparticles synthesised by green method. Green method is a low cost, non toxic and environment friendly

method using plant parts. In this work we have used phytochemicals from Simarouba glauca leaf extract as the precipitating and capping agent. The obtained nano particles have been characterised by XRD, FT-IR, UV, SEM and TEM. The results revealed a sphere like morphology of cubic spinel having average particle size 9 nm for the prepared materials. Batch adsorption experiment showed that the prepared nanoparticles have good adsorption efficiency for removing Pb (II) ions from aqueous media. The adsorbent could be easily separated from the reaction mixture and reused again

Keywords: green method, spinel, heavy metal ions, phytochemicals, capping agent.

ABICNAN2019100161

Design and Characterisation of 1-D Titanium Oxide Nanorod Array as Electron Transport Medium

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This article summarises the design of one dimensional Titanium oxide (TiO_2) nanorod array and its compatibility as Electron Transport Medium (ETM) for Perovskite Solar Cell (PSC). The approach followed for the growth of the one dimensional nanostructures was one step hydrothermal synthesis which is convenient for commercialization. A series of microscopic characterisation such as XRD, SEM and EDAX were carried out to analyse the structure and morphology of the prepared TiO_2 array. The band gap was determined using UV-DRS analysis. Field dependent dark and photoconductivity studies showed positive response confirming the effective photoconducting nature of the as-prepared samples. As a result, all these features validate the usage of one dimensional titanium oxide array as efficient ETM in the fabrication of PSCs.

Keywords: Titanium Oxide, One dimensional nanorod arrays, Microscopic analysis, Photoconductive , PSCs.

ABICNAN2019100162

Phenolic Pesticide(Pronto®)-Carbon Nanotube Chemically Modified Electrode And Its Electrocatalytic Oxidation of L-Cysteine

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Phenol based pesticides PRONTO (PT) have been recommended for various agricultural cultivations. Indeed, fraction of these pesticides is carried over via food chain route to human and creates several health hazardous. Followings are some of the diseases associated with the pesticides; dermatitis, leukemia, lymphoma and kidney cancer. Probing mechanism relating to the pesticide interaction with biological systems is an important research topic in toxicology, biochemical and clinical areas. Unfortunately, most of the small biological molecules like O_2, H2O2 and cysteine are associated with non-chromophoric system and hence it is not easy task

to study its interaction with the test chemicals by spectroscopic techniques. It is believed that when pesticide/s enters in the physiological system it can interact with various biomolecules and disturb the physiological functions. Herein, we introduced a new methodology for the study of interaction of pesticide with biological molecules by using chemically modified electrode approach, wherein, the toxic pesticide is first modified on suitable electrode surface and further extended to study for electrochemical oxidation and reduction interaction with the target biochemical. In this work, phenolic pesticide has been modified on a Double Walled Carbon Nanotube (DWCNT) modified electrode GCE/DWCNT and tested electrochemical interaction by performing cyclic voltammetric experiment with various biochemicals. It has been found that L-Cysteine was interacted on the pesticide modified electrode via mediated oxidation reaction at 0.1 V vs Ag/AgCl in pH 7 phosphate buffer solution. GCE/DWCNT@PT shows redox peak at E^0 = 0.1 V vs Ag/AgCl and show electrocatalytic oxidation signal for L-Cysteine at 0.1V vs Ag/AgCl. Details relating the mediated oxidation and sensing of L-cysteine were provided as independent study in this work.

Keywords: Glassy Carbon Electrode (GCE), PRONTO (PT), Double Walled Carbon Nanotube (DWCNT), L-Cysteine (L-CySH)

ABICNAN2019100163

Solvothermally Synthesized Anatase Titania Nanoparticles as High Rate Sodium Ion Battery Anode

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Sodium ion batteries (SIB) are emergent technologies which has potential application in areas of grid storage and portable devices. However, the choice of an excellent anode material for SIB is not successful yet. Herein, we report a facile, single-step solvothermal synthesis of titanium dioxide nanoparticle. The synthesized TiO_2 nanoparticles of average particle size 15-20 nm is crystallized in anatase phase and are demonstrated to have high-rate capability (10C) and excellent cycling stability with negligible capacity decay even for 2000 cycles.
Keywords: Anatase, TiO_2, sodium ion battery, anode, solvothermal synthesis.

ABICNAN2019100164

PEG Assisted Solvothermal Synthesis of $Ag_{1-x}Ni_xFe_2O_3$ an Evaluation of its Properties

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Nickel- silver ferrite nanoaparticle was synthesized by Solvothermal technique using PEG as the solvent and characterized using XRD, FTIR, SEM, TEM and VSM. The comparison on relative amounts of strains eliminated or inhibited were analyzed using ultraviolet – visible spectroscopy. The drug delivery efficiency of the superparamagnetic nickel- silver ferrite sample was conducted with curcumin. Results indicate the changes in properties due to the presence of silver and poly ethylene glycol in nickel ferrites.
Keywords: solvothermal technique, PEG, XRD, drug delivery, curcumin.

ABICNAN2019100168

Cobalt-Tungsten- Borate (Co-W-B) as a Bifunctional Electrocstlist for Hydrogen Evolution and Oxygen Evolution Reactions in Alkaline Water

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Ternary alloy catalysts in the form of Co-W-B were synthesized with different molar ratios [W/(Co+W)] by chemical reduction method at room temperature. All the powders were tested for catalytic activity and among them Co-4%W-B (4% W/W+Co) showed best activity with current density of 10mA/cm^2 at 148mV for HER and at 293mV for OER in pH14. It also sustains up to 1000 cycles. It shows stable activity for about 20hrs which proves it as a stable low cost electrocatalyst. Tafel slop value of 31 mV/dec suggests Volmer- Heyrovsky reaction. The role of elements in enhancing the catalytic activity was justified with the help of XPS, BET, XRD and SEM.

Keywords: Ternary alloy catalysts, Amorphous metal borides, Bifunctional electrocatalyst, Co-W-B.

ABICNAN2019100171

Biogenic Synthesis of Mesoporous Silica from Ground Nut Shell And Banana Peel as a Carrier for Dap and Map Fertilizer and Its Potential Application in Agrochemical Delivery System

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Soil nutrients deficiency resulted in great loss for farmers and nutritional uptake of plants. Leakage of chemical fertilizer damages soil fertility, decreases plant growth by depleting nutrients. Nanotechnology prevents loss by loading fertilizer in mesoporous silica (MS) for controlled release of fertilizers to minimize nutrients loss. MS synthesized from Silica rich biogenic wastes Banana peel and Groundnut shell. The Ammonium phosphate[(DAP), (MAP)] phosphorous rich fertilizers loaded with MS and forms loaded D-MS M-MS which facilitates controlled delivery. AFM, FT-IR, XRD and SEM characterize the loaded fertilizers, these further studied for targeted delivery and prolonging delivery time in soil and water.

Keywords: Mesoporous silica, plant nutrients, fertilizer, controlled release.

ABICNAN2019100173

Effect of Annealing Temperatures on Ferromagnetic Behaviour of Nickel Oxide Thin Films by Enviornmental Friendly Sol-Gel

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Nanocrystalline cubic phase of NiO thin films were fabricated by sol gel spin coating method. The prepared thin films were annealed at different temperatures at 300°C-600°C. The structural, optical and magnetic properties with different annealing temperatures were studied

using Xray diffraction technique (XRD), Ultraviolet-Visible spectroscopy and Vibrating sample magnetometer (VSM) characterization techniques. The XRD pattern revealed that the prepared thin films were polycrystalline. High transmittance of 79-89% were obtained for annealed NiO thin films. Decreasing band gap and increasing saturation magnetization with increasing annealing temperatures were observed for all prepared thin film.so these films were suitable for optoelectronic and magnetic devices.

***Keywords**:* sol-gel, NiO, Transmittance, Bandgap, Ferromagnetism.

ABICNAN2019100176

Photocatalytic Activity of ZnO/Cu/ZnO Multilayered Thin Films Prepared by Sol-gel Spin Coating Technique

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Sol-gel spin coating technique has been successfully employed for the preparation of monolayer, bilayer, and multilayer zinc oxide thin films on the glass substrate. The photocatalytic activity of multilayer zinc oxide thin films was evaluated on the basis of degradation of malachite green (MG) dye under UV irradiation. The formation of p-n junction in multilayered zinc oxide thin films dissociate the excitons and this will cause the photoluminescence quenching and enhancement of degradation rate of malachite green in multilayered zinc oxide thin films.

Keywords: photocatalysis, zinc oxide, multilayer thin films.

ABICNAN2019100177

Synthesis and Characterisation of Carbon Nano Tubes over Hollow Glass Microspheres and its Nano Composites

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Hollow Glass Microspheres (HGM) is now challenging reinforcement for making low density composites with high stiffness, good electrical and mechanical properties. Carbon nano tubes when reinforced homogenously in the matrix it enhances properties of the composites to a commendable range. These CNT are grown over HGM using chemical vapor deposition (CVD) technique at different process temperatures to optimize the growth temperature. Initially HGM were nickel coated by electroless deposition technique using nickel sulphate as the source of metal in the alkaline bath and then the catalyst coated HGMs were exposed to the mixture of acetylene and nitrogen gas at various temperatures to form CNT over HGM. Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) images explores the quality and dimension of CNT. Other characterizations such as XRD, Raman Spectroscopy confirm the presence of CNT. Using these coated HGM as fillers in Epoxy composites were fabricated and the same was characterized for compression using UTM and DMA using DMA analyzer.

Keywords: CVD, HGM, Raman Spectroscopy, Electroless Deposition

ABICNAN2019100180

Significance of Entangling Operators in the Modified EWL Scheme

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Recently a modified approach to Eisert, Wilkens and Lewenstein (EWL) quantization scheme has been proposed with an aim to explore the two-qubit entangling operators in the domain of game theory. In the present work, we show the implications of such a modification by considering the possibility of conversion of symmetric to potential game, when one of the players uses a quantum strategy while the other resorts to classical strategy. Secondly, we show that conversion of symmetric to potential games can be done through operators which are perfect entanglers.
Keywords: EWL scheme, Perfect entanglers, Quantum strategies, Zero sum games, Symmetric games.

ABICNAN2019100181

XOR Implementation of Hybrid MOS Transistor with Memristor for Full Adder

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Resistive devices with Memory characteristic feature is explored to overcome the limitations of the CMOS technology scaling. Here, the design of XOR gate with PMOS transistors with Memristors is accomplished. This design is implemented in 90nm CMOS technology in Cadence Virtuoso and simulations are brought about using Spectre. The power dissipation and delay is reduced when compared with conventional CMOS. Finally it is used in full adder design.
Keywords: Resistive device, Memory, Memristor, XOR gate, CMOS technology.

ABICNAN2019100182

Magnetite/Poly(Vinylidene Fluoride) Based Piezoelectric Nanogenerator Having Electromagnetic Interference Shielding Capability

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Poly(vinylidene floride) {PVDF} and its copolymers, well-known for their promising piezo-, pyro- and ferro-electric response, have been classified as a model-system in fabrication of easily scalable high power-density nanogenerators with large breakdown strength and intrinsic reciprocal conversion capability. For the enhancement of its electroactive β-phase and electromagnetic (EM) shielding; magnetic electret nanoparticles are embedded in PVDF matrix. Magnetite nanoparticles (MNP) of two different size of ferrimagnetic and superparamagnetic nature are used to fabricate self-poled composite thin film devices. XRD, FTIR and Raman spectroscopy are employed to characterize the composite, whereas Mössbauer spectroscopy is used to perceive the magnetic property and finally its piezo-response is assessed.
Keywords: Piezoelectric nanogenerator, electromagnetic shielding, superparamagnetic nanoparticles, electret.

ABICNAN2019100184

Surface Engineered Si-SiO Composite Electrodes for Cost-Effective Li-Ion Batteries

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Attracted by the remarkable properties like high theoretical capacity and low lithiation potential, silicon (Si) based electrode materials have attained significant research interest as lithium ion battery electrodes. SiO had gained importance as it can improve the structural stability that leads to a high energy density anode for lithium ion battery. In an effort to improve the structural stability, we have surface engineered commercial Si-SiO composite bulk particles by coating amorphous TiO_2 on surface of Si-SiO micron-sized particles (termed as Si-SiO@TiO_2). Characterization results revealed the formation of TiO_2 coating on the surface of Si-SiO particles. Si-SiO@TiO_2 sample exhibited good electrochemical performance delivering 522 mAh/g capacity at a current density of 1A/g for of 100 cycles. This results confirm that Si-SiO@TiO_2 sample can be used to replace expensive silicon electrodes and thereby enable low-cost, high energy density full-cells for energy storage applications.
Keywords: Silicon, Si-SiO@TiO_2, structural stability, lithium-ion battery.

ABICNAN2019100187

2D FeS_2 Nanoplate and Fe_2O_3 Nanosphere Heterostructure Modified Electrode for Photoelectrochemical Oxygen Evolution Reaction (POER)

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To develop low-cost but highly active electrocatalysts alternatives to noble metals, remains a challenge for photoelectrochemical water splitting. Hydrothermally synthesized 2D Pyrite (FeS_2) and 0D Hematite (Fe_2O_3) nanoparticles heterostructure were investigated as electrode material for POER. The Fe_2O_3 act as protective layer over FeS_2 against their chemical oxidation as well as FeS_2@ Fe_2O_3 hybrid electrode shows good POER performance compared to the bare Fe_2O_3 electrode. This notable improvement of PEC performance can be explained due to coupling of small band gap FeS_2 with Fe_2O_3nanospheres. The proposed heterojunction between FeS_2@Fe_2O_3 photoelectrode follows Z scheme, which might be helpful to lower recombine rate and increase the efficiency of PEC water spitting in the infrared light region, and thus can make a significant contribution in the field of energy conversion.
Keywords: Pyrite, Hematite, Heterostructure, OER

ABICNAN2019100189

Protective Role of Biosynthesized Zinc Oxide Nanoparticles on Pancreatic Beta Cells: An *In Vitro* and *In Vivo* Approach

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The current study aims at developing a potent antidiabetic drug that has low side effects and better management of its associated conditions. Rat insulinoma cell lines (RIN-5F) was used

to determine the cytotoxic effects and morphological changes in response to Zinc Oxide nanoparticles (ZnO NPs). Streptozotocin (STZ)-fructose induced type II diabetic rats treated with ZnO NPs exhibited a significant reduction ($p<0.01$) in the blood glucose levels, total cholesterol, triglycerides and LDL levels and increase ($p<0.01$) in serum insulin and liver antioxidant enzyme levels proclaiming its role as a hypoglyceamic and hypolipidaemic drug. Conclusively ZnO NPs have protective role on pancreatic beta cells.

Keywords: Zinc oxide nanoparticles, RIN-5F, Cytotoxicity, Streptozotocin, Hypoglyceamia.

ABICNAN2019100192

Optimization of Batch Parameters for Enhanced Recovery of Copper from Waste Printed Circuit Boards using Biometabolized Acids

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Rapid advancements in the information and communication technology have benefitted consumers in different ways but led huge e-waste generation. Environmentally friendly processes to recover valuable metals from e-waste are concerned by many researchers. In this investigation, the capability of bio-metabolized acids in solubilizing copper from waste mobile phone printed circuit boards was examined. Different bio-metabolized acids were used for leaching of copper and the results found that citric acid to be more effective. Experiments were designed using central composite design to examine the interaction effects of several parameters affecting copper leaching rates. The CCD design was able to determine the interactions and model the leaching at R2 > 0.9, which indicates a high correlation of experimental responses with model predictions.

Keywords: E-waste, Mobile phones, bioleaching, recovery, metals, organic acids.

ABICNAN2019100196

Designing MoO_3 monolayers on $NiCo_2S_4$ for charge storage application

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Advanced energy storage systems are in urgent demand to satisfy the requirements of fast-growing electrical vehicle applications. The challenge in this realm is to design cost effective catalyst with enhanced functionalities for advance energy storage and conversion. We have designed MoO_3 monolayers on $NiCo_2S_4$ surface by varying temperature method. MoO_3 forms flexible protective layers on conductive core material ($NiCo_2S_4$). The final material MoO_3@$NiCo_2S_4$ is obtained in the form of nanospheres which show high specific capacitance of 1600 F g^{-1} at 2 A g^{-1} and a good capacitance retention of 91% after 6000 cycles. This is a novel strategy to design materials for supercapacitor electrodes. The charge storage activity of MoO_3@$NiCo_2S_4$ is attributed to its high surface area and electrical conductivity, which

provides a broad ion diffusion pathway, low charge-transfer resistance, and robust structure at high current density for long-time cycling.
Keywords: Supercapacitor, $NiCo_2S_4$, nanospheres, layer structure.

ABICNAN2019100197

Low Energy Plasma for Direct Insertion of Nitrogen in Graphene Domain

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In this study, microplasma discharge produced by applying high electric potential between the graphite and Pt electrodes in acetonitrile solvent. The electron generated in microplasma discharge collides with acetonitrile and produce ˙H and ˙CH_2CN radicals. The radicalized graphene layer exfoliated from the graphite electrode, react with nascent hydrogen (˙H) and acetonitrile (˙CH_2CN) radicals and partially restores the aromaticity and its conjugation. The superior fluorescence property of N-FG confirms the presence fluorophores such as —NH and —N=C— at the radicalized graphene sites and it was further supported by ultraviolet-visible spectroscopy (UV-Vis) and X-ray photoelectron spectroscopy (XPS) studies.
Keywords: Nitrogen functionalized graphene; plasma; acetonitrile radicals.

ABICNAN2019100199

Synthesis of VO_2 Nanosheets and Study of Their Electrical Response to Ambient Moisture Levels

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Here, we present the synthesis of two dimensional VO_2 nanosheets and we evaluate the effects of ambient moisture levels on its electrical behavior. For a range of humidity levels between 0.6% to 1.1% VO_2 nanosheets showed linear variation in resistance. The humidity sensitivity of as-synthesized VO_2 nanosheets was found to change by about 1.22 MΩ/RH%.
Keywords: VO_2 nanosheets, solvothermal synthesis, humidity sensing.

ABICNAN2019100201

Study of Behaviour of Water Droplet with Surface Temperature on the Nanostructures Grown by Glancing Angle Deposition

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In present work, we carried out a comparative study of the behavior of the water droplet on the planer and nanostructured silicon surfaces with varying surface temperature. Experiments were done on silicon nanostructures grown by Glancing angle deposition. The droplet of the fixed volume was dropped from normal to the surface with a constant rate. In the low-temperature regime spreading of the water droplet was observed for both planers as well as nanostructured surfaces. However, in the high-temperature region rebounding of the water droplet was

observed for the nanostructured surfaces. An additional boiling regime, pseudo-Leiden frost regime was observed in case of the nanostructured surface.

Keywords: Droplet, porosity, Glancing angle deposition, temperature.

ABICNAN2019100203

Structural, Dielectric, and Magnetic Properties of Double Perovskite- La_2CoNiO_6 Ceramics Synthesized by Wet Chemical Route

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The polycrystalline double pervoskite- La_2CoNiO_6 ceramics were successfully synthesized by facile wet chemical route. The X-ray diffraction pattern has confirmed the formation of rhombohedral phase of perovskite with $R\bar{3}c$ symmetry. The X-ray photoelectron spectroscopy exhibited the presence of La^{3+} ions, Co^{2+}/ Co^{3+} ions, and Ni^{2+} ions. The temperature and frequency dependent dielectric and impedance analysis have exhibited the effect of grains and grain boundaries in the relaxation process. Further, La_2CoNiO_6 ceramics is a new ferromagnetic semiconductor in this class by exhibiting spin glass transition at low temperature.

Keywords- Double perovskites, oxides, wet chemical, structural, ceramics.

ABICNAN2019100204

Upconverion Photoluminescence Properties of $ZrO_2:Er^{3+}$ Phosphor Irradiated with 120 MeV Gold Ions

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$ZrO_2:Er^{3+}$ (1 mol%) nanoparticles were synthesized by the solution combustion technique. The effect of irradiating with 100 MeV Au^{9+} ions on the down conversion and upconversion emission are reported. Green and red emission at 548 and 660 nm corresponding to $^4S_{3/2} \rightarrow {}^4I_{15/2}$ and $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions are observed when the $ZrO_2:Er^{3+}$ phosphor is excited with 390 and 980 nm light respectively. The green emission response is enhanced by Au ion irradiation when compare to pristine. The obtained results allow for identification of down and upconversion photoluminescence mechanism.

Keywords: $ZrO_2:Er^{3+}$, Swift heavy ion, Photoluminescence, Down and upconversion.

ABICNAN2019100207

CoS and NiS Nanostructures Grown on Human Hair Derived Carbon Fibres for Supercapacitor and Hydrogen Evolution Reactions

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The carbon fibers (CFs) from abundantly wasted human hair were produced via solvothermal and calcination techniques. The solvothermal technique helps to retain the fibrous structure and calcination improvises graphitization. The produced CFs show relatively less current response. In order to make this CFs efficient, CoS and NiS were grown on CFs. The structure, morphology confirmation was done using XRD, XPS, FESEM, TEM techniques. The composite is evaluated as supercapacitor electrodes and hydrogen evolution (HER) catalysts. The current study shows the effective use of the waste human hair as the source for CFs. Also, its use in energy storage and conversion process.

Keywords: Huan hair, Supercapacitors, hydrogen evolution reaction.

ABICNAN2019100211

Flexible Supercapacitor Electrode Using Vertically Aligned Carbon Nanotubes

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Vertically aligned carbon nanotubes (VACNT) on the metallic substrate has emerged as one of the best candidate for supercapacitor application. Carbon nanotubes (CNT) on a conductive material like aluminium is a favorable combination but difficult to grow. In this work, a methodology to grow a thin layer of VACNT on flexible aluminium foil by thermal chemical vapor deposition is reported. Effect of variation in flow time of carbon source (acetylene) and growth temperature has been studied. For the growth of VACNT, a layer of catalysts material (Fe) having a coating thickness of 20 nm is used. A specific capacitance of 3.78 mF/cm2 is observed at a scan rate of 800 mV/s from the VACNT coated flexible aluminum foil electrodes. Moreover, the wettability study shows a contact angle of more than 140° leads to a superhydrophobic and self-cleaning surface.

Keywords: Aluminium foil, VACNT, CVD, Supercapacitor, Flexibility.

ABICNAN2019100212

Electrochemical Performance of Portia Tree Seed Derived Activated Carbon-Supercapacitor and its Improved Energy Density in Redox Additive Electrolytes

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Supercapacitors (SCs) are a promising energy storage device in the zone of energy stockpiling gadgets. In the last few decades, various kinds of carbon-based materials with reasonable surface alterations, metal oxides, and their different composites have been utilized as electrodes to improve the energy density of SCs. Also, device fabrication with various electrode configurations like asymmetric and hybrid systems are introduced. Similarly, the electrolytes can also improve the energy density through redox processes at the electrode-electrolyte interface. Herein, a high energy supercapacitor is demonstrated using activated high surface area carbon derived from bio-source and redox additive electrolyte. The hydroquinone based redox additive showed very high specific capacitance of 895 F/g at 3 A/g and 525 F/g at 1 A/g in three and two electrode system, respectively. The overall performance of the redox additive

supercapacitor shows the maximum energy and power density of 115 Wh/ kg and 25 kW/kg, respectively.

***Keywords*:** Redox additive; supercapacitors; energy storage; bio-carbon; high energy density.

ABICNAN2019100214

Solvent Composition Induced Structure Control of Cadmium Sulfide Nanoparticles and Investigations on Photocatalytic Degradation of Methylene Blue

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The structural regulation of nanoparticles is a challenging task without any structure determining agents such as templates, surfactants, etc., In the present study, the structure of the CdS NPs has been effortlessly changed from hexagonal to face centered cubic structure under solvothermal conditions by facile volume ratio adjustment of the solvents water and ethanol used for synthesis. It has been observed that the structure, size and morphology of the CdS NPs vary with respect to the solvent composition. The CdS NPs prepared have been prudently investigated using various characterization techniques and used as photocatalysts for the degradation of organic dye Methylene Blue (MB).

Keywords: CdS, Nanoparticles, Photocatalysts, Methylene Blue, Dye Degradation.

ABICNAN2019100220

Magnetic Hyperthermia Properties of Zwitterionic Ligand Grafted Magnesium Ferrite Nanoparticles

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Magnetic hyperthermia is emerging as an independent as well as adjunct therapy for cancer treatment. Magnetic hyperthermia efficiency is dependent on magnetic material, particle size distribution and colloidal stability of the material. Here we report magnetic hyperthermia properties of nearly monodisperse and zwitterionic ligands grafted $MgFe_2O_4$ nanoparticles at room temperature. The nanoparticles were synthesized by solvothermal reflux method and zwitterionic dopamine sulfonate ligand was grafted on nanoparticles to increase the colloidal stability. X-ray diffraction analysis shows well crystallined samples with average crystallite size of 8 nm and field emission scanning electron microscopy micrographs show average particle size of 17 nm. The spinel crystallinity and ligand coating on nanoparticles were also confirmed by infrared spectrum. Magnetic hysteresis loop of the sample shows superparamagnetic nature at room temperature. The coated nanoparticles exhibited mean zeta potential of -31.63 mV which represents good colloidal stability. Magnetic hyperthermia efficiency of $MgFe_2O_4$ nanoparticles at 1 mg/mL and 3 mg/mL concentration were studied under an alternating magnetic field strength of 443 Oe and frequency 316 kHz. The 1 mg/mL and 3 mg/mL samples show 265 W/g and 328 W/g respectively. The obtained values are superior to similar magnetic nanoparticles. The results were discussed through magnetic spin relaxation phenomenon.

Keywords: Solvothermal reflux, Magnetic hyperthermia, Superparamagnetic, Ferrites, Colloidal stability.

ABICNAN2019100222

Performance Analysis of Graphene Based Operational Amplifier with Conventional for Future Communications

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Graphene plays a vital role in today's communication because of its excellent and novel properties. Here, in this paper, we present a comparative analysis of graphene based FET as operational amplifier with a conventional Metal-Oxide-Semiconductor (MOS)FET for analog applications. Low power dissipation is essential in any device. This paper aims to compare two op amps. One is based on GNRFET and other is a conventional MOSFET. Using the op amp model, we are able to calculate the voltage gain, output resistance and power dissipation of GNRFET op amp and compare it with conventional MOS. Our study shows that graphene based analog circuits will exploit more applications due to lower power dissipation and low output resistance.

Keywords: graphene, op amp, power dissipation, gain, output resistance.

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Effect of Annealing Temperature on Structural, Optical and Electrochemical Study of $BiPo_4$ Nanostructures Assisted through Microwave Technique

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In the present study we report influence of annealing temperature (150°C, 300°C, 600°C) on microwave assisted synthesis of $BiPO_4$ nanostructures for supercapacitor applications. The XRD patterns indicate the pure phase formation of $BiPO_4$ without any impurity phase for all the samples synthesized at different temperature (JCPDS #15-0766). FWHM values of the diffraction peaks are observed to decrease with increase in annealing temperature which can be attributed to increase in particle size. The synthesized materials are in nanometer range which is further confirmed by FESEM analysis. UV visible spectroscopy, FTIR and Raman spectroscopy is studied to explain the structural and optical properties of the synthesized material. Cyclic voltammetry, GCD (galvanostatic charge discharge) and EIS are studied to explain the electrochemical properties.

Keywords: Supercapacitors, microwave, FESEM, specific capacitance, charge-discharge.

ABICNAN2019100225

Structural and Morphological Studies of Chemically Deposited Nanocrystalline and Nano-Flower like $Cu_2ZnSnSe_4$ Thin Films

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The rising environmental and economical apprehensions have encouraged forceful attention of researchers for fabrication of earth-abundant, non-toxic and inexpensive photovoltaic materials by economical method. The $Cu_2ZnSnSe_4$ (CZTSe) is strongly emerging as an alternative material inexpensive and greener thin film solar cells due to its constituent elements are abundant and safe. The CZTSe semiconductor has direct band gap, p-type conductivity and high absorption coefficient greater than 10^4 cm^{-1} which gives low cost, greener option to synthesize thin film solar cells. We report synthesis of $Cu_2ZnSnSe$ thin films by suitable chemical bath deposition technique. The films were characterized by different techniques.

Keywords: Thin films, nanoflower, CZTSe, kasterite.

ABICNAN2019100227

Magnetic Hyperthermia Properties of Zwitterioinic Dopamine Sulfonate Chemisorbed $ZnFe_2O_4$ Nanoparticles

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Zinc ferrites magnetic nanoparticles were prepared by solvothermal reflux method using high boiling point organic solvent and suitable surface ligands. The synthesized nanoparticles show single phase spinel structure with high degree crystallinity. The as-synthesized hydrophobic nanoparticles were converted into hydrophilic nanoparticles by completely removing hydrophobic surface ligands and chemisorbed the hydrophilic zwitterionic dopamine sulfonate. Fourier transformed-infrared spectra confirms the zwitterionic surfactant on nanoparticles surface. Nanoparticles show narrow size distribution with average particle size of 12 nm and high colloidal stability with zeta potential of -33 mV. Thermal stability and surface ligand quantification was carried out by thermogravimetric analysis. Nanoparticles show superparamagnetic nature at room temperature. Hydrophilic $ZnFe_2O_4$ nanoparticles show heating power of 393.4 &216 W/g of nanoparticles at 1 & 3 mg/mL concentration under alternating magnetic field strength of 443 Oe and frequency of 316 kHz. The obtained heating capacity is higher than other ferrite nanoparticles and may be useful for magnetic hyperthermia applications in cancer therapy.

Keywords: Solvothermal reflux, Magnetic hyperthermia, Zinc ferrite nanoparticles, Surface ligands, Zeta potential.

ABICNAN2019100230

Interfacial Coupling Effect of Pyrochlore $Ce_2Zr_2O_7$ Over the 2D G-C_3N_4 Sheets for the Efficient Removal of Organic Pollutants under Direct Solar Light Illumination

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Highly efficient, visible light active new hybrid pyrochlore based $Ce_2Zr_2O_7$/g-C_3N_4 photo catalyst with robust stabilities has been synthesized through facile hydrothermal method. This study deliberates the photo catalytic removal of organic pollutants through photo catalysts g-C_3N_4, $Ce_2Zr_2O_7$ and g- C_3N_4 / $Ce_2Zr_2O_7$ under visible-light irradiation. The essential properties of the prepared photo-catalyst have been studied thoroughly. As prepared $Ce_2Zr_2O_7$/g-C_3N_4

composition exhibits superior photocatalytic efficiency for the removal under the direct solar light irradiation. The characterization results of UV-Vis DRS, PL and electrochemical measurements confirmed that the $Ce_2Zr_2O_7$/g-C_3N_4 exhibited the fast charge transfer and the more visible spectral response. The chemical state of the elements was confirmed by the XPS measurement. The chemical bonding and their adverse effect were analyzed by the Raman and FTIR spectroscopy. The charge transfer mechanism between the composition and the photocatalytic reaction was predicted by the trapping experiment, based on that necessary mechanism and equation were proposed.

***Keywords*:** Pyrochlore, Nano cubes, 2 D materials, Trapping.

ABICNAN2019100234

Synthesis of CuTi LDH Supported on g-C_3N_4 for Electrochemical and Photoelectrochemical Oxygen Evolution Reaction

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We facilely synthesized nanocomposite CuTi LDH supported on g-C_3N_4 (15 wt.% of g-C_3N_4) having electrostatic interactions between positively charged sheets of CuTi LDH and negatively charged g-C_3N_4 sheets. The nanocomposite CuTi LDH@ g-C_3N_4 was characterized through various analytical techniques, and successfully applied as both electrocatalyst and photoanode for OER. Linear sweep voltammetry for OER was performed at 50 mV/s in dark and in light. There is improvement in photocurrent density, up to 2.3 mA cm^{-2} at 1.23 V vs. RHE under visible light illumination of 30 min. Also, the onset potential of CuTi LDH@ g-C_3N_4 for OER appears at η = 0.43 V in dark and η = 0.39 in light.

Keywords: Photoelectrochemistry, Z-scheme, LDH, g-C_3N_4, OER.

ABICNAN2019100236

Fabrication of Superhydrophobic Cotton Surface using UV Irradation for Multipurpose Use

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Eco-friendly and affordable techniques to fabricate superhydrophobic clothes. In the recent study, a superhydrophobic cloth was prepared by simple immersion technique. This is the two-step process. Initially, nanoparticles coated cloth was prepared exposing UV irradiation. Later, the low surface energy materials such as fatty acid and silane were used to tune the wettability of the cotton clothes. The static water contact angle of the superhydrophobic cotton was measured to be 159°. The cotton fabric has the excellent water repellence ability with washing durability. So, it can be concluded that the modified cotton fabric has the potential to meet the future demands.

Keywords: Superhydrophobic, washing durability, self-cleaning, stain-resistant.

ABICNAN2019100239

Effect of Different Capping Agents on the Surface Chemistry of Platinum Metal Nanoparticles: Synthesis, Characterization and In Vitro Toxicity Studies on WRL68 Cell Line

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Platinum nanoparticles are widely used for applications in catalysis, biological and drug delivery given their unique physico-chemical properties. Wet-chemical reduction method was used for synthesizing platinum nanoparticles in one-pot with high yield and monodispersity. Ascorbic acid, citrate and cetyltrimethylammonium bromide were used as capping agents for synthesizing platinum nanoparticles of sizes less than 20nm. The capping agent has an influence both on the size and shape of nanoparticles. Characterization techniques were used to determine their size, surface charge, shape and the crystal structure. We assessed the safety of differently charged platinum nanoparticles on WRL68 cells using various vitro toxicity assays.
Keywords: nanoparticles, synthesis, platinum, characterization, in vitro.

ABICNAN2019100243

Fabrication and Charcterization of Embedded Ge Nanoclusters in SiO_2 Matrix via Low Energy Ion Implantation

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In this work we have fabricated the system of embedded Ge NCs in the SiO_2 matrix by ion implantation technique. Low energy ions give the flexibility to choose the right amount of ions and the depth at which they should be situated. 30 *keV* Ge ions were implanted into a thermally grown SiO_2 matrix on Si(100) substrates with three different fluences (2.5×10^{15}, 5×10^{15} and 1×10^{16} *ions/cm*^{2}). Ex-situ annealing was done at 600 and 800 *°C* and Raman measurements have been performed after each annealing process. Finally, XTEM analysis has been done on the 800 *°C* annealed specimens.
Keywords: Embedded nanostructures, Ion implantation, Raman, TEM, sequential annealing.

ABICNAN2019100246

BSA Augmented ROS Generation from Anthrarufin Derived Carbon Dot

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Amplification of Reactive Oxygen Species (ROS) generation through covalent conjugation of Bovine Serum Albumin (BSA) with newly synthesized, ROS producing Carbon Dot (CD) upon visible light irradiation is reported for the first time. Derivatization of surface carboxyl

functional groups of Anthrarufin derived green emitting CD with amine functionality of BSA usher distinct changes in photophysics of CD including an unprecedented ~50 nm shift in its excitation maxima, decrease in fluorescence lifetime and concomitant increase in ROS generation. Substantial conformational changes of BSA were witnessed upon conjugation with CD, rendering the BSA-CD conjugate resistant to pepsinolysis.

Keywords: carbon dot, reactive oxygen species, bovine serum albumin, anthrarufin.

ABICNAN2019100248

A Comparative Study of Temperature Dependent Thermal Conductivity of Silicon, Silicon Nanowire, Germanium and Germanium Nanowire by Nonequilibrium Molecular Dynamics Simulation

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Nowadays, modeling and simulation is evolving because it is a critical tool for researchers which allow optimizing designs without complication and the significant cost of nanofabrication processes. Nonequilibrium Molecular dynamics simulations (NEMD) are performed to explore the temperature dependent thermal conductivity in Bulk Silicon (Si), Silicon square nanowire (SiSqNw), Germanium (Ge), Bulk Germanium Square Nanowire (GeSqNw). In this paper, the Stillinger-Weber potential is used.

Keywords: Thermal Conductivity, Nonequilibrium Molecular Dynamics Simulation.

ABICNAN2019100250

Bare Plasmonic Metal Nanoparticles: Synthesis, Characterization and In Vitro Toxicity Studies on Liver Carcinoma Cell Line

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Bare plasmonic metal nanoparticles have potential for biolabelling and sensing applications given their pristine nature. Bare metal nanoparticles are synthesized using wet-chemical method. We synthesized gold, silver and platinum nanoparticles in high yield and monodispersity without capping agent. The metal nanoparticles are in the size range of sub-20 nm and are stable for 2 weeks. We evaluated the sensing capabilities of bare metal nanoparticles for detection of several heavy metals and screened their sensitivity and specificity. The bare metal nanoparticles were also tested for their toxicity responses towards liver carcinoma (HepG2) cell line to assess their safety.

***Keywords*:** bare, metals, sensing, synthesis, toxicity.

ABICNAN2019100251

Large Resistance Change Near Room Temperature in Disordered NbN Thin Film

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Niobium Nitride (NbN) thin film is deposited on oxidized silicon substrates using reactive DC sputtering process. The NbN thin film is patterned into four probe geometry for electrical resistance measurement. Magnetoresistance measurements were performed with magnetic fields for temperatures between 4 K to room temperature. While superconductivity was observed at 12.24 K at zero field, an anomalous resistance variation was seen between temperatures of 250 K to 295 K. The large change in resistance saturates below 250K and is also unaffected on application of magnetic field.
Keywords: Niobium Nitride, Superconductivity, Thin films, Sputtering, Magnetoresistance.

ABICNAN2019100252

Iron Based Nanomaterial Sheets for Electromechanical Applications

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A mixture of Nano powder of iron oxide and blend of Single Walled Carbon Nanotubes provides great promising properties towards the Electromechanical applications by enhancing their electrical and mechanical properties. In this paper we will discuss the characteristics and behaviour of newly synthesized nanoparticle sheet whose major constituent is iron. This paper will also explore the advantages and disadvantages over the conventional Iron sheets used in electromechanical applications. For synthesizing the nanoiron sheets, among different methods we used nanoemulsion method in which we mixed two nanoparticle in different phase to get the desired result.
Keywords: Nano-Structure, Nano-Science, Nano-materials, Nano-emulsion, Nano-sheet.

ABICNAN2019100253

$CsPbCl_3$ Perovskite Nanogenerator for Mechanical Energy Harvestor

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Here, we have synthesized high quality cesium lead chloride perovskite ($CsPbCl_3$) cube with one side 400 nm long. Phase purity and structural confirmations are revealed by XRD and EDX analysis. Further photoluminescence measurement and UV-vis analysis confirms it optical activity. We have fabricated a piezoelectric nanogenerator by PVDF with $CsPbCl_3$. FTIR spectrum and Raman spectroscopy approves β phase enhancement of the PVDF. This piezoelectric nanogenerator (PNG) exposes excellent output voltage and current. The PNG shows output voltage about 12 volts under simple finger touch and display good cyclic stability even after 15000 cycles.

Keywords: Perovskites, cesium lead chloride, β phase, PVDF, piezoelectric nanogenerator.

ABICNAN2019100254

Covalent Immobilization of Horseradish Peroxidase on Acetate Functionalized Ionic Liquid/Multiwalled Carbon Nanotube Platform: Direct Electrochemistry and Hydrogen Peroxide Biosensing

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In this study, we report a naphthyl substituted acetate functionalized ionic liquid for the covalent anchoring of HRP using which the direct electrochemistry of HRP was successfully accomplished and a H_2O_2 biosensor was developed. The naphthyl substitution on the NpAc-IL was utilized for the π-π stacking with the MWCNT and the terminal O-CH_3 group of NpAc-IL were used for the covalent attachment with the free NH_2 group of HRP enzyme via amide bond formation. High conducting nature of the NpAc-IL facilitated an improved conductivity to communicate with the deeply buried redox centre of the HRP, while the covalent bonding provided an enhanced stability to the fabricated biosensor. Furthermore, incorporation of MWCNT on the sensor setup synergistically enhanced the sensitivity of the developed biosensor. Thus, fabricated biosensor showed an excellent stability with improved sensitivity and selectivity.
Keywords: Ionic liquid, electrochemical biosensor, hydrogen peroxide, horseradish peroxidase, MWCNT.

ABICNAN2019100255

Investigations on Tribological Property of Non-Catalytic CVD Synthesised Carbon Spheres In Lubricant

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The effect of Carbon Spheres (CS) on the tribological property of lubricating oil was studied. Relatively uniform Carbon Spheres with size ranging from 200 to 350 nm were obtained using non-catalytic Chemical Vapour Deposition (CVD) method. Morphological studies and material structure characterization were carried out using SEM and XRD techniques. The friction and wear studies were performed using a four ball tester and the results show that an addition of 0.3 wt% carbon spheres in the base oil reduces its coefficient of friction by 10 %.
Keywords: Carbon Spheres, Tribology, Lubricants, additives.

ABICNAN2019100259

Eulerian-Eulerian Mixture Modelling of Forced Convective Heat Transfer Around a Square Bluff Body Using Nanofluids

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Nanofluids are suspension of nanoparticles in traditional coolants. This work uses $Al_2O_3 - H_2O$ nanofluid for numerically analysing the rates of forced convective heat transfer from a square bluff body. The prime aim of this work is to highlight the effects of slip velocity on the heat transfer rates. Multi-Phase Modelling (MPM) is preferred. One can observe improved heat transfer rate with increase in volume fraction, Reynolds number and with decrease in diameter of particles. This implies that enhanced heat transfer rates are achieved by using nanofluids with higher Reynolds number, higher number of smaller particles.

Keywords: Square bluff body, Nanofluid, Multi-Phase Modelling (MPM), Slip velocity.

ABICNAN2019100261

Direct Electrochemistry of Covalently Immobilized Hemoglobin and Detection of Hydrogen Peroxide on a Naphthyl Substituted Carboxyl Functionalized Ionic Liquid/Multiwalled Carbon Nanotube Modified Electrode

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Monitoring the concentration levels of hydrogen peroxide (H_2O_2) is highly significant in both clinical and industrial applications. Herein, we develop a facile biosensor for the detection of H_2O_2 using direct electron transfer of hemoglobin (Hb), which was covalently immobilized on hydrophobic naphthyl substituted COOH-IL (NIBA[TFSI]) over MWCNT modified GCE. Highly water-soluble Hb protein was stably immobilized on NIBA[TFSI] via stable amide bond formation between the free -NH_2 group of Hb and -COOH group of NIBA[TFSI] through EDC/NHS coupling reaction. Further, the modified electrode demonstrated excellent electrocatalytic activity towards reduction of H_2O_2 and showed a wide linear range from 0.01 to 6.3 mM with a limit of detection 3.2 μM and sensitivity of 110.56 μA $mM^{-1}cm^{-2}$. The fabricated biosensor displayed high operational stability even under dynamic conditions as well as for continuous potential cycles and showed reliable reproducibility.

Keywords: hydrogen peroxide, ionic liquid, hemoglobin, direct electron transfer, biosensor.

ABICNAN2019100262

Designing Electrochemical NADH Sensor Using Silver Nanoparticles/Phenothiazine Nanohybrid and Investigation on the Shape Dependent Sensing Behaviour

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The detection of NADH has become extremely significant because it plays an important role in biological processes. Accordingly, simple non-enzymatic sensor (PTZ/AgNPs/SPE) was developed by fabricating nanohybrid comprising of silver nanoparticles (AgNPs) with phenothiazine (PTZ) redox molecule in order to facilitate electrocatalytic detection of NADH.

AgNPs with different shapes like rod, prism and sphere were synthesized and the influence of shape dependent catalytical performance of modified electrodes was examined. Moreover, the developed PTZ/AgNPs/SPE sensors showed good selectivity, sensitivity, stability and reproducible electrocatalytic activity.

Keywords: phenothiazine, redox mediator, nanoparticle, NADH sensor.

ABICNAN2019100266

Visible Light Photocatalysis in Cobalt Doped TiO_2 Nanocrystals Promoted by the Formation of TiO_2-Co_3O_4 Hetero-Junction

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Cobalt doped TiO_2 nanocrystals were synthesized by peroxide gel method. The nanocrystals were characterized by X-ray diffraction, transmission electron microscopy, UV-visible absorption, micro-Raman, and X-ray photoelectron spectroscopies. The different characterization techniques confirmed the incorporation of Co ions into the TiO_2 lattice but with the segregation of Co_3O_4 for higher Co dopant concentrations. The photocatalytic activity of the samples was probed by choosing methyl orange as the model compound. The enhanced visible-light photocatalytic activity of the Co-doped samples at higher dopant concentration is ascribed to the formation of hetero-junctions between the n-type TiO_2 and the p-type Co_3O_4 semiconductors.

Keywords: TiO_2 nanocrystals, Cobalt doping, visible light photocatalysis.

ABICNAN2019100270

An Ab-Initio Study of Electronic Properties on Pure and Doped Anatase Titanium Dioxide using Meta GGA

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The present work reports about the structural and electronic properties of a 2×2×2 titanium dioxide doped supercell using all electron OLCAO basis set under the framework of density functional theory. Here, electronic properties such as the band diagram and density of states of pure and co-doped supercell are studied and analyzed.

Keywords: Anatase TiO_2 supercell, N and Nb doped TiO_2, N and Ta doped TiO_2, MGGA.

ABICNAN2019100273

Effect of A-Site Doping on Magnetocaloric Effect in Nano-Sized Dysprosia (Dy_2O_3)

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In this paper, A-site (Gd and Tb) doped nano-sized dysprosia (NSD) were synthesized using the sol-gel method and crystallographic, magnetic and magnetocaloric properties of NSD were characterized using X-ray diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), X-ray photoelectron spectroscopy (XPS) and Squid. The magnetic and electronic properties of NSD were studied by using Density Functional Theory (DFT). Both DFT and experimental results showed, A-doping in NSD significantly decreased the bandgap, which could be due to the repression of oxygen vacancies. Magnetic results showed, enhancement of magnetocaloric effect in A-site doped NSD.
Keywords: Nano-sized dysprosia (NSD), Magnetocaloric effect, Density of states (DOS).

ABICNAN2019100278

Characterization of CNT and Its Carrier Mobility Dependency on Diameter in Back-Gated CNT-FET

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Based on the chiral indices, different structures like an arm chair, zigzag and chiral are formed and carbon nanotube (CNT) shows semiconducting and metallic properties. This is a very interesting phenomenon in the field of nanoelectronics research. Some fundamental parameters like diameter, bandgap, number of hexagons in a unit cell, and temperature affect on the carbon nanotube properties. These parameters may also change the carrier mobility in the carbon nanotube based back-gated field effect transistor (FET). Diameter (directly proportional with mobility) and temperature (inversely proportional with the mobility) dependency is very much important on charge density.
Keywords: Carbon nanotube, chiral indices, characterization, mobility, field effect transistor.

ABICNAN2019100279

Tailoring Biodegradation of Magnesium Alloys by Organic Acid Pickling

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Magnesium based alloys are suitable candidates for developing degradable metallic implants. However, the rapid degradation of these alloys in physiological environment limits their use for such applications. In this work, the effect of acetic acid pickling of the alloys on surface morphology, composition and degradation rate are investigated. The acid treatment resulted in the formation of magnesium acetate layer on the surface which reduced the degradation rate and improved the wettability of the samples. The degradation resistance is further reduced during the immersion test in simulated body fluid (SBF) due to the formation of biomimetic calcium phosphate on the surface.
Keywords: Mg-Ca alloy, biodegradation, acetic acid, contact angle, orthopaedic implants.

ABICNAN2019100282

Temperature Dependent Electrical and Optical Properties of Chemical Vapour Deposition (CVD) Grown p-Type Cu_2O

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Cuprous oxide (Cu_2O) is a promising material for emerging electronics. Cu_2O film was grown on SiO_2/Si substrates at 600°C by LPCVD technique using metal-alkoxide-based metal-organic precursor. XRD and XPS confirmed phase purity and SEM showed a granular film. Electronic properties were observed using temperature-dependent Hall measurement from 5K to 300K. The results show that the film is p-type doped and resistivity decreases from 1.2 Ωcm to 4.14×10^{-2} Ωcm, mostly due to increase in mobility from 3.32 $cm^2/(V\ s)$ to 57.39 $cm^2/(V\ s)$ and carrier concentration remained within a narrow band of $2.5\times10^{17}cm^{-3}$ to $4.5\times10^{17}cm^{-3}$. The photoluminescence shows emission energy of copper and oxygen vacancies at ~1.4eV and ~1.72eV respectively.
Keywords: Photoluminescence spectroscopy, Hall measurement.

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Interaction CA Doped ZnO Nanostructures with MRSA

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Nanomaterials are often composed of alkaline and inorganic materials which can use to the treatment of bacterial infection. In this investigation, ZnO and $Zn_{0.085}Ca_{0.015}O$ nanoparticles (NPs) were synthesized by a co-precipitation method. The antibacterial studies were performed against Methicillin-resistant *Staphylococcus aureus* (MRSA) strain and $Zn_{0.085}Ca_{0.015}O$ NPs possessed a greater antibacterial effect than the pure ZnO NPs. Field emission scanning electron microscopy analysis revealed the existence of bacterial loss of viability due to an impairment of cell membrane integrity, which was highly consistent with the damage of cell walls. From their energy dispersive spectroscopy spectra, the aggregates of the NPs containing Zn and Ca elements showed a number of $Zn_{0.085}Ca_{0.015}O$ NPs gathered on the surface of MRSA.
Keywords: MRSA, ZnO, $Zn_{0.085}Ca_{0.015}O$, nanoparticles.

ABICNAN2019100286

Cleaner Energy, Greaner Profits: A Contribution in the Journey toward Sustainable Hydrogen Economy

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With this abstract/presentation, I would like to give a brief overview of my efforts toward sustainable hydrogen generation. Electrochemical hydrogen generation *via* water splitting include two half-cell reactions, *i.e.,* cathodic hydrogen evolution reaction (HER) and anodic water oxidation reaction (WOR). Among which, WOR is the bottleneck to improve the overall

energy efficiency of hydrogen generation. With my first work, I have focused to design a low-cost electrocatalyst to boost-up only WOR. In the second work, I have focussed to introduce bifunctionality to catalyze both the half-cell reaction. And, in my third work, I have designed a bifunctional catalyst to generate H_2 directly from urine.

Keywords: Water Electrolysis, Hydrogen Evolution Reaction, Oxygen Evolution Reaction, Urine Electrolysis, Layered Double Hydroxide (LDH).

ABICNAN2019100287

Selective Adsorption of Cationic Dyes using Nickel Sulfide Nanomaterials

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The L-glutathione capped nickel sulfide nanomaterials were synthesized as an adsorbent for the selective adsorption of cationic dyes. As-synthesized nickel sulfide nanomaterials were characterized using various techniques such as XRD, FE-SEM, TEM, EDX, XPS, TGA, Zeta-potential, and FT-IR. The adsorbent exhibited high selectivity and adsorption capacity of 1001.65 mg g^{-1} and 1946.61 mg g^{-1} for methylene blue (MB) and crystal violet (CV), respectively. The adsorption for MB and CV followed Freundlich isotherm models and pseudo-second-order kinetics. The mechanism of interaction is electrostatic. The assynthesized nanomaterials could be used as a promising adsorbent for separation of dyes and wastewater treatment.

Keywords: Nickel sulfide nanomaterials, Cationic dyes, Selective adsorption.

ABICNAN2019100288

Comparative Investigation on the Interplay between Absorber Layer Crystallinity and Interfacial Defect States over Performance of Lead-Based and Tin-Based Perovskite Solar Cells

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This paper presents the investigation on the relative influence of crystallinity and interfacial defect states of the absorber layer in Pb-based (toxic) and Sn-based (non-toxic) perovskite solar cells using SCAPS-1D. The results reveal that both these parameters play a critical role towards the efficiency of PSCs. The in-depth analysis of results elucidate that in comparison to Sn-based PSC, the Pb-based PSC are more prone towards crystallinity variations inside absorber and increasing density of defect states at the absorber/HTM interface than at ETM/absorber interface. The findings are key towards achieving the better performance of Sn-based PSCs over Pb-based PSCs by incorporating near to defect-free absorber layer.

Keywords: Perovskite, lead, tin, defects, SCAPS-1D.

ABICNAN2019100292

Solution Processed Polyvinyl Alcohol Nanocomposite Films Reinforced with Graphene Quantum Dots and Nickel Oxide Nanoparticles for Gas Sensing Applications

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Graphene quantum dots (GQDs) and nickel oxide (NiO) nanoparticles (NPs) reinforced polyvinyl alcohol (PVA) nanocomposite films were prepared using solution casting technique. The physico-chemical characteristics of PVA/GQDs/NiO nanocomposite films were evaluated using Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetric analysis (TGA), scanning electron microscopy (SEM) and atomic force microscopy (AFM). The synthesized PVA/GQDs/NiO nanocomposite films showed good mechanical flexibility, improved tensile strength and sensitivity towards various gas molecules. The impact of variable loadings of nanofillers on the overall sensing performance of PVA/GQDs/NiO nanocomposite film was investigated with respect to different gases at various concentrations and temperatures.
Keywords: GQDs, NiO, PVA, gas sensing, polymer composites.

ABICNAN2019100293

Synthetic Modification of Pamam Dendrimer to Enrich Branched Amine Group and Terminal Carboxyl Group for Environmental Remediations

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Dendrimer with amine group has several applications in the various fields such as dye degradation, heavy metal removal, sensors etc. Especially, dendrimers having enriched amino groups with accessible void makes significant impact in the above fields. Herein we report the microwave assisted synthesis of Poly(amidoamine) (PAMAM) G_3 dendrimer using magnetite silica nanosphere as core material. The resulting nanomaterial containing amide groups are subsequently reduced by using lithium aluminum hydride to yield magnetite silica cored poly (N- propyl ethane- 1,2- diamine) (PEDA) G_3 dendrimer nanoparticle with enhanced amine groups when compared with PAMAM G_3. Further, the terminal amine groups are grafted with succinic anhydride to have carboxylic acid periphery. The efficacy of carboxylate terminated amine dendrimer has been demonstrated for the removal of hardness as well as heavy metals from the ground water.
Keywords: magnetic core, PAMAM dendrimer, modified PAMAM, hardness removal, heavy metals.

ABICNAN2019100295

Perpendicular Magnetocrystalline Anisotropy Energy (MAE) of 111-Surface Slab of Fe_2CoAl(FCA)

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Atomic orbital resolved magnetic crystalline anisotropy energy (MAE) of inverse Heusler alloy Fe_2CoAl (111) surface has been studied using first principle calculation based on density functional theory (DFT). It has been found that antiferromagnetic configured Al-terminal and ferromagnetic Co-terminal exhibit in-plane magnetic anisotropy. However, a collective in-plane and out-plane magnetic anisotropy has been found in Fe-terminal.

Keywords: MAE, Heusler alloy, DFT.

ABICNAN2019100296

Surface Modified Nano-Biochar for Delivery of Zinc in Maize

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Slow release fertilizers are expected to mitigate the challenge of excessive use of agrochemicals causing environmental risk. Present slow released formulations suffer from high synthesis costs, thus making it unsuitable for commercial use. This study investigates biochar in its nano form as carrier for delivery of micronutrients, particularly Zinc (Zn) which is commonly deficient in many crops. Our result showed increased functionality of nano-biochar compared to bulk. Adsorption of Zn on nano-biochar was favoured by acidic pH within 3h of contact time. Surface functionalization of nano-biochar and uptake and translocation of Zn loaded nano-biochar in maize is presently under investigation.

Keywords: Biochar, Rice husk, Micronutrient, Nano- biochar, Zinc.

ABICNAN2019100297

High Quality Crystallization of Perovskite Films for Solar Cells Applications

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Solar energy, the auspicious and gifted source of energy; it can be easily converted to electrical energy. The research on Perovskite materials rapidly increasing in solar cells application because, its efficiency reaches above 22%. Although, numbers of efforts have been made to increase the life time and stability, still several complicated processes are required to achieve better structural and chemical stability. In this paper we prepared the perovskite material in different molar ration combination of PbI_2 and MAI for better interdiffusion and structural stability. The Synchrotron source-based x-ray and SEM analyses were also performed in order to optimize understand the structural properties of such films. This ultimately results in increasing overall performance and also able to provide better resistibility to the odds (humidity etc.,)

Keywords: Perovskite Materials, Synchrotron source-based X-ray, Device Stability.

ABICNAN2019100298

Fabrication and Characterization of PIN Photodetector using Intrinsic Layer Bismuth Ferrite.

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This research work reports on fabrication of p-i-n photodetectors with multiferroic bismuth ferrite (BFO) as an intermediate layer. Organic poly (3, 4-ethylenedioxythiophene): poly (styrenesulfonate) (PEDOT: PSS) with band gap of 1.6 eV were used as hole transporting layers (p-type) and undoped ZnO layers were used as an electron transport layer (n-type). Multiferroic bismuth ferrite (BFO) perovskites layers will be used an intermediate layer between the p-n hybrid junctions. The intrinsic BFO thickness were varied as 174 nm and 385 nm for n-ZnO /i-BFO/p-PEDOT PSS/Ag device. The effect of intrinsic layer thickness in the current-voltage (I-V) characteristics and photoresponse switching properties were investigated.
Keywords: Thin films, Semiconductor, Multiferroics, UV Photodetector.

ABICNAN2019100299

Formation of Hierarchical Nano-structures of Gold Particles in Self-aligned Polymer Nano-structures

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Polymer melts have been recently reported by the author to form self-aligned nano-strips and nano-fibre-like structures in confined geometries using simulation technique. Experimental data also validates for the existence of similar structures, though not the same. This paper further extends the work for the investigation of hierarchical nano-structures formed by gold particles within the polymer matrix. This has been found to be a useful experimental technique to synthesize aligned array of nano-dots, which have different semi-conducting properties. Monte Carlo simulation technique has been used to first prepare the self-aligned polymer nano-structures, and then gold particles are placed in different compositions and temperatures to observe the nucleation process of gold particles and formation of new structures.
Keywords: Monte Carlo simulation, Gold nano-particles, Quantum dots, Dewetting

ABICNAN2019100301

Formation of Liquid Structures and Investigation of Its Interfacial Properties Using Lattice Based Lquidgas Model

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This paper highlights the formation of liquid structures under influence of confinement of attractive surfaces. Lattice based Monte Carlo simulation has been used for investigating various types of nano-structures; which may vary from spherical drop, lamellar structures to nano-structured bridges and liquid columns. It has been observed that strong surface affinity to liquid-like molecules leads to formation of liquid column-like structures forming interfaces with gas-like molecules in between them. We explore various possible structures by tuning interfacial parameters, molecular interaction, temperature, and interaction range of surfaces used there in. We evaluate density profile, pressure and surface tensions to explain the sen structures and their dependence on these observables.

Keywords: Monte Carlo simulation, Wetting, Ising models.

ABICNAN2019100302

Dielectric and Microwave Shielding Performance of $SrTiO_3$ Nanoparticles Reinforced Polyvinylchloride and Polyvinylidenefluoride Blend Nanocomposites

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Strontium titanate ($SrTiO_3$) nanoparticles (NPs) reinforced polyvinyl chloride (PVC) and polyvinylidenefluoride (PVDF) blend nanocomposite films were prepared using solution blending technique. The as prepared samples were characterized by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), atomic force microscopy (AFM), thermogravimetric analysis (TGA) and the mechanical property investigations including Young's modulus and tensile strength. The dielectric and electromagnetic interference (EMI) shielding properties of PVC/PVDF/$SrTiO_3$ nanocomposite films were also examined. The EMI shielding analysis reveals that the composite exhibits absorption behaviour with 73.9 % (12 GHz) absorption at 10 wt% of $SrTiO_3$ loading.

Keywords: $SrTiO_3$, PVC, PVDF, EMI shielding.

ABICNAN2019100305

Improved Dielectric Performance of Polyvinylformal/Titanium Dioxide Nanocomposites for Hybridcapacitor Application

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Polyvinyl formal (PVF)/Titanium dioxide (TiO_2) nanocomposite films were preparedwith different loadings of TiO_2 nanoparticles (NPs) by solution casting method. Thesynthesized PVF/TiO_2 nanocomposites were characterized by Fourier transform infraredspectroscopy (FTIR), X-ray diffraction (XRD), Scanning electron microscopy (SEM), Thermogravimetric analysis (TGA), and dielectric measurements. The results from thestructural analysis confirmed that the TiO_2NPs were uniformly dispersed in the PVF matrix.TGA results demonstrated improved thermal stability of PVF/TiO_2 nanocomposites. The effect of TiO_2 loading on the dielectric properties of PVF matrix was evaluated at different frequencies (50Hz to 10MHz) and temperatures(40° C to 150°C). The addition of TiO_2 NPs inthe PVF matrix resulted in the enhancement of dielectric properties owing to the formation ofa more effective network between TiO_2 and PVF matrix.

Keywords: TiO_2, thermal analysis, polyvinyl formal, electrical properties, SEM

ABICNAN2019100306

Photoinduced Phase transitions in Nematic Droplets for Photonic applications

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We prepare monodispersed photoresponsive azoxydianisole doped Nematic(N) liquid crystal (E7) droplets dispersed in an aqueous solution of 3wt% PVA solution by using flow focussing glass capillary microfluidic device. We will study the UV irradiation-photo induced Nematic to isotropic transitions in Hexgonally closed packed (HCP) array of droplets and in flat geometry by measuring the time and temperature resolved transmitted intensity from a Photodetector.

Keywords: Photoresponsive, Phase transitions, Liquid crystal, Flow focusing, Droplets.

ABICNAN2019100310

First Principles Insights of NO_2 Detection via III-V Nitride Nanoribbons with Armchair Edges

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The development of low-dimensional robust sensors is an area of huge potential. Here, we investigated the sensing of NO_2 molecule on the edges of armchair III-V nitride nanoribbons (AXNNR, X=B/Al/Ga). Five different adsorption sites are considered for NO_2 adsorption and the modulation of electronic and transport properties has been observed for its potential detection. Interestingly, semiconducting to perfect metallic transition has been noticed due to NO_2 intereaction. The selectivity of NO_2 with respect to N_2 is higher as compared O_2. Further, some of the selected structures exhibit negative differential resistance (NDR) phenomena which suggest that NO_2 adsorbed AXNNR could also be used for fast switching devices and oscillator applications.

Keywords: Nanoribbons, sensing, negative differential resistance (NDR), selectivity.

ABICNAN2019100313

Local grain to grain conductivity in SnO_2 –V_2O_5 nanocomposite ethanol sensor

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Herein, tin oxide - vanadium oxide nanocomposite was prepared by hydrothermal route. The morphology and conductive atomic force microscopy (CAFM) studies were employed to explore the interface properties between the grain and grain boundaries of binary oxides. From the detailed studies, it is revealed that the barrier height of 0.512eV favours pronounced sensitivity of 63.99% at room temperature for 160 ppm. This might be attributed to the decrease in the resistance from 2000 M Ω to 830 M Ω. The synergistic effect, large surface area, more number of interfaces and more conduction electrons contributes for the better sensing characteristics.

Keywords: tin oxide, vanadium oxide, CAFM, barrier height.

ABICNAN2019100316

First-Principles Design of Nano-Porous Graphene Membranes for Efficient Separation of Halogen Gases

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Atomically thick layers of 2-D materials can serve as a potential candidate for ultra-thin membranes. Here, we investigated the capability of nano porous graphene (NPG) membranes towards efficient halogen separation. Porosity was induced in graphene membranes via deliberate removal of host C atoms. A number of vacancies viz 4, 6a, 6b, 8 and 10 were examined with and without functionalization to gauge the halogen selectivity of these NPG membranes. Analysis of potential energy profiles reveal that no selectivity could be obtained without functionalization of the pore rim. However, after functionalizing the pore via F/Cl/H, NPG membranes could possibly differentiate between the halogen molecules.
Keywords: Graphene membrane, Functionalization, Selectivity, Electron density isosurface.

ABICNAN2019100317

Large Magnetocaloric Effect in Rare Earth Substituted Gadolinium Oxide Nanostructures

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A simple, hydrothermal method has been used to fabricate one dimensional, 5% Erbium substituted gadolinium oxide (5%Er-Gd_2O_3) nanostructures. Magnetization measurements confirm the paramagnetic behaviour of 5%Er-Gd_2O_3 from 300 K down to 5 K. Magnetocaloric effect (MCE) is assessed in terms of isothermal magnetic entropy change (ΔSm) at low temperatures. The maximum ΔS_m value at 6 K for 70 kOe field change is about -23.5 $Jkg^{-1}K^{-1}$. This value is quite large and therefore rare-earth ion doped Gd_2O_3 nanostructures could be useful in magnetic refrigeration applications at low temperatures.
Keywords: Nanostructures, Magnetic properties, Magnetocaloric effect

ABICNAN2019100320

Effect of Oxygen during growth of Copper and its Oxide Thin Films Using Chemical Vapor Deposition

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The deposition of crystalline Cu metal, mixed phase (Cu and Cu_2O) and CuO nanostructure on FTO substrate obtained by vapor-phase decomposition of copper (II) acetylacetonate ($Cu(acac)_2$) using cold-wall chemical vapor deposition (CVD). This work is carried out to enable a better understanding of the possibility of growth of copper and its oxide nanoparticles with varying the flow rate of oxygen. The X-ray diffraction (XRD) and Raman spectroscopy analysis confirmed structure and phase purity of deposited films. The scanning electron microscopy (SEM) shows uniform distribution of grain, which is also confirmed by atomic

force microscopy (AFM). With change in oxygen flow, average grain size and roughness were varied due to change in crystal structure of deposited film.

Keywords: Chemical Vapor Deposition (CVD), Thermogravimetry (TG).

ABICNAN2019100321

Structural Characterization and Electrical Conductivity Studies of $NiFe_2O_4$ Nanofibers Synthesized by Electrospinning Technique

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Nanocrystalline ferrites (MFe_2O_4) are the current focus of researchers because of their usage in numerous applications like recording media, spintronic, microwave devices, etc. Ferrites are also used as a gas, humidity sensor, as well as anode material for lithium-ion battery. $NiFe_2O_4$nanofibers were prepared by using the electrospinning technique. XRD and FT-IR spectroscopy results confirm the formation of cubic spinel structured $NiFe_2O_4$nanofibers. AFM results confirm the formation of $NiFe_2O_4$ nanofibers. The impedance measurements were carried out at different temperatures and frequencies. The electrical conductivity of $NiFe_2O_4$ nanofibers at 300 K is found to be 6.39×10^{-6} S cm^{-1}.

Keywords: $NiFe_2O_4$, Nanofibers, XRD, AFM, Impedance.

ABICNAN2019100326

Preparation of Supporting Photocatalysts for Water Treatment Using Natural Sunlight as an Alternative Driving Energy

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The present study focusses on the synthesis of visible-light active Fluoride (F)- and Silica(S)-doped titanium dioxide (TiO_2) photocatalyst. The sol-gel process of synthesis is adopted. Characterizations such as SEM, XRD, FTIR, DLS revealed about the crystallinity, physico-catalytic properties of the photocatalysts. The nanomaterials were tested for their photocatalytic properties against methyl orange, oil and grease and chemical oxygen demand (COD) remediation. It is noteworthy that the as-synthesised materials best acted on target parameters under natural sunlight (visible range). Specifically, Si-doped $TiO_2$was superior over F-doped and pure (undoped) TiO_2 in terms of degradation efficiencies.

Keywords: Titanium dioxide, Photocatalysis, Sunlight, F-TiO_2, Si-TiO_2

ABICNAN2019100327

Phenolic Rich Bark Extract of *Terminalia Arjuna* Mediated biogenic Silver Nanoparticles and Their Antimicrobial Andanticancer activities

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A rapid one step process was achieved for the synthesis of silver nanoparticles (AgNPs) using phenolic rich bark extract of *Terminalia arjuna*. Characterization of AgNPs was performed by using different analytical tools and techniques. Synthesized AgNPs were potentially cyto toxicto human breast cancer cell line (MCF7) in a dose and time dependent manner as assayed through MTT [3-(4,5- di methyl thiazol-2-yl)-2,5-diphenyltetrazolium bromide] assay and nuclear staining method. Further, the synthesized AgNPs were found to possess marked antimicrobial activity against bacterial strains (Escherichia coli, Salmonella typhimurium, Klebsiella pneumonia, Bacillus cereus and Staphylococcus aureus) and one fungal strain (Aspergillus niger).

Keywords: Terminalia arjuna, Silver nanoparticles, MCF7, Antimicrobial

ABICNAN2019100331

Massive Enhancement of Charge Storage in Plasma Nitrogen Implanted Graphene Nanowalls

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Graphene nanowalls (GNWs) are used as super capacitor electrodes due to its enormous surface area and conducting nature. Towards improving the properties, nitrogen plasma ion implantation is carried for 2 minutes at 1kV. Surface morphology is largely un-affected; whereas, the surface become superhydrophilic after implantation. Enhancement in supercapacitive behavior by three orders is observed in the electrochemical studies. Raman and XPS studies shows change in defect structure and chemistry. C-AFM studies shows large reduction in electrical conduction of the GNWs. The increase in active area, microscopic random distribution of charge and enhancement in sp^3C regions account for the supercapacitiance. The new methodology offer great potential for supercapacitor electrode development.

Keywords: Graphene nanowalls, supercapacitor, implantation, XPS, CA

ABICNAN2019100333

Chlorophyllin Sensitized Carbon Nitride Scaffolds for Photocatalytic Applications

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Polymeric carbon nitride (CN) scaffolds are broadly investigated in photocatalytic energy production and environmental purification applications. However, the visible light absorption behaviour of CN catalysts is limited to ~ 460 nm. Here, we attempt to extend the visible light absorption capacity of CN towards longer wavelength with elevated photoactivity. Modification of CN *via* immobilization of photosensitizer such as chlorophyllin (Chl) is likely to extend and enhance the photocatalytic dynamics. A series of Chl-CN hybrids were prepared by impregnation route, and thoroughly characterized to understand the physico-chemical characteristics. The effect of Chl-sensitization on CN surface is extensively correlated to the observed photoactivity.

Keywords: Photocatalysis, Chlorophyllin, CN, Chl-CN

ABICNAN2019100334

Non Metallic Photocatalyst Immobilized Millicappilaries as Optofluidic Reactors for the Continuous Flow Disinfection of Water Under Direct Sunlight

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Providing safe drinking water is one of the biggest challenges in developing countries. Photocatalytic disinfection is one of the efficient ways towards the disinfection of water. Here, we immobilized non-metallic photocatalyst fibrous red phosphorus in 3.5mm inner diameter quartz capillary by solid state synthesis. In situ synthesized fibrous structure is well characterized and the band gap of the material is 1.9 eV which is optimum band gap for the visible light photocatalyst. Antibacterial studies were performed by passing known concentration of bacterial solution through the quartz capillary under direct sunlight. The disinfection process through the catalysts immobilized capillary will minimize the post purification process.

Keywords: Red phosphorus, Fibrous red phosphorus, SODIS, E.coli, Photocatalytic disinfection, Immobilization of photocatalyst

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Magnetism and Magnetocaloric effect in Melt-Spun, Nanostructured $GdAl_2$

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Magnetocaloric effect (MCE) in melt-spun rare earth intermetallics compound $GdAl_2$(Cubic, $MgCu_2$-type) is studied. The sample gets nanostructured upon melt-spinning and the crystallite size is about 48 nm. A sluggish paramagnetic to ferromagnetic transition is noticed with a TC of ~136 K. The maximum isothermal magnetic entropy change (ΔSm) is found to be ~ 7 $Jkg^{-1}K^{-1}$ at 111 K for 70 kOe field change. This value is quite comparable to that of bulk sample prepared by arc-melting.

***Keywords*:** Magnetic properties, Magnetocaloric effect.

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Selective Interfacial Interaction in Reduced Graphene Oxide/Hydroxyapatite Nanocomposites: a Combined NMR and FTIR study

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Hybrid composites of hydroxyapatite and reduced graphene oxide have been prepared byultrasonication method. ^{1}H NMR as well as ^{31}P NMR T_1 measurements on the compositesshowed that the OH environment was unaffected in the nanocomposite formation and thatchanges in ^{31}P spin-lattice relaxation times were mainly due to chemical shift

anisotropy. FTIR results showed evidence for complexation through the appearance of new peaks as well as a shift in the C = C stretching frequency.
Keywords: Hydroxyapatite, Graphene oxide, Nanocomposite, Chemical Shift Ansiotropy.

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Triboelectric Nanogenerator for Wheel Energy Scavenging and its Self Powered Security Application

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Vehicles have been an indispensable part of our daily life. Electricity is the prime source of energy that drives various complex systems embedded in an automobile. Generating energy and supplying to all the systems is a tedious process. In accordance to which, we propose a Triboelectric nanogenerator (TENG) that can scavenge the mechanical energy from the rotary motion of tires to electrical energy and its self-powered security application. This is emerging as an innovative technology which overcomes the periodic replacement of battery. It acts as a battery-free sensor which assists in preventing the Car-theft which a critical situation is prevailing in our country.
Keywords: Self-powered, triboelectric nanogenerator, automobile, car-theft, scavenge.

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Biosurfactant Mediated Synthesis of CuO Nanoparticles and their Antibacterial Activity towards Who Priority Pathogens

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CuO nanoparticles are known to show antibacterial activity, catalytic and photocatalytic applications. Several synthesis methods are known to synthesis CuO nanoparticles. However, synthesis of these Cu nanoparticles using biosurfactants is unexplored. Here we propose rahmno lipid a bio surfactant to produce CuO nanoparticles and the antibacterial activity of obtained nanoparticles was examined towards the WHO priority pathogens
Keywords: Biosurfactants, CuO, Hydrothermal synthesis, Antibacterial activity, Zone inhibition method.

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Synthesis of Bismuth Oxide Nanoparticles Using Natural Honey

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Bismuth Oxide Nanoparticles were prepared using Honey. This is the first report to synthesis the Bismuth oxide using honey as a reducing agent and green method. The single phase Bismuth Oxide (α-Bi_2O_3) Nanoparticles were synthesized and confirmed by X-ray Diffraction (XRD) study and Scanning electron Microscope (FESEM) image shows the morphology of the prepared sample in flower shape. The obtained band gap is 3eV.
Keywords: Bismuth Oxide, Honey, XRD, FESEM, UV-Vis DRS.

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Thickness Dependent Magneto-Transport Properties of Topologically Nontrivial DyPdBi Thin Films

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In this work, we report the observation of a two-dimensional (2D) weak antilocalization (WAL) effect, one of the hallmarks of topological surface states, and Shubnikov-de Hass (SdH) quantum oscillations in <110> oriented DyPdBi (DPB) thin films grown on MgO (100) substrates. We highlight the observations of WAL and SdH oscillations arising from the surface states in the magneto-transport data obtained on the DPB thin films. Band structure parameters extracted from magneto-tranport data shows presence of surface dominated transport below 40nm thick film and bulk dominated transport above 40nm thick film.

Keywords: Lifshitz- Kosevich, quantum, thin film.

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Photocatalytic Activity of Commercial Red Phosphorus- Reduction of Chromium (VI) and Disinfection of *E.Coli* Under Direct Sunlight

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Photocatalysis have become more attention towards the disinfection of water as well as reduction of toxic metals. Hexavalent chromium [Cr (VI)] compounds are carcinogenic in nature in order to reduce Cr (VI) to Cr(III) which is non-toxic. Hence development of non-metallic photocatalyst red phosphorus is one of the good promising candidates to reduce Cr (VI) and also disinfection of water. Commercial red phosphorus is synthesized hydrothermally and characterized. The band gap of the material is 1.9 eV which is optimum band gap for the visible light photocatalyst. Antibacterial studies were performed with *E.coli* as model pollutant and complete disinfection occurs in 50 minutes under direct sunlight. The chromium (VI) reduction also occurs in 3 hours.

Keywords: Red phosphorus, Hydrothermal activated, Chromium (VI) reduction, *E.coli*, Photocatalytic disinfection

ABICNAN2019100353

Enhanced Dielectric Properties of Carbon Black Nanoparticles (CBNPs) Reinforced PVA/PEG Nanocomposite Films for EMI Shielding Applications

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The nanocomposites with various loadings of Carbon black nanoparticles (CBNPs) and Poly (ethylene glycol) (PEG), in a water-soluble polymer, Polyvinyl Alcohol (PVA) were prepared by using solution casting technique. The structural properties of PVA/PEG/CBNPs nanocomposites were investigated by using Fourier transform infrared (FTIR) spectroscopy and ultraviolet–visible (UV–Vis) spectrophotometry, indicating the strong interaction between

incorporated filler and the polymer matrix. The dielectric measurements of PVA/PEG/CBNPs were carried out at temperature ranging from 40 °C to 150 °C over a wide range of frequencies from 50Hz to 20MHz using impedance spectroscopy.

Keywords: Carbon black Nanoparticles, PVA, PEG, EMI shielding and Dielectric property.

ABICNAN2019100354

Hydrothermal Synthesis of Spinel Based Metal Oxides and the Influence of Secondary Phases in Asymmetric Supercapacitors

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In an ever-increasing energy demand, the search for cost-effective, sustainable, renewable energy-based fuels has gained more attention. Supercapacitors are new generation electrochemical charge storage devices with high power density and long stability cycles. The charge storage is usually carried out by Faradaic and non-Faradaic process. Spinels are type of mixed metal oxides which show supercapacitor behaviour through a Faradic process. The present research work involves synthesis and characterization of complex oxides of spinels Ex. $NiCo_2O_4$, and test their efficiency in super capacitor applications.

Keywords: Asymmetric Supercapacitors, Spinels, $NiCo_2O_4$, nanorods, Pseudocapacitance

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Enhanced Room Temperature Synthesis of Li@F-MWCNTs for Hydrogen Uptake Application

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The hydrogen sorption capability of Li@f-MWCNTs has been examined at 253 K, 298 K and 70 bar pressure. To facilitate the hydrogen adsorption/desorption by Li@f-MWCNTs, experimental conditions have been optimized by altering metal concentration and solvents (Water, Amine and Dimethyl formamide (DMF)). Morphology and structure were characterized by TEM and XRD. The adsorption isotherm reveals that the hydrogen uptake capacity of Li@f-MWCNTs synthesized at different experimental conditions was 0.63 wt % (Water), 0.85 wt % (Amine) and 1.13 wt % (DMF) at 253 K temperature and 70 bar pressure. A 2-3 fold increase in hydrogen uptake was observed at 253 K compared to 298 K in all samples. Furthermore, a substantial increase in hydrogen uptake capacity (4 fold) was observed compared to pristine material.

Keywords: Functionalization, P-MWCNTs, f-MWCNTs, Metal nanoparticles, Hydrogen Uptake

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Porous Organic Polymer-Coated Permselective Separator for Lithium Sulfur Batteries

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The shuttling of polysulfides between the electrodes in a lithium–sulfur battery (Li–S) system remains a challenge to be addressed in order to achieve the full potential of this promising technology. Multifunctional membrane separators with permselectivity or localizing abilities placed between cathode and anode plays a crucial role in suppressing the migration of polysulfides. POP was synthesized and coated on a commercial 2320 Celgard membrane. The coating has enhanced the wettability and there by showed an improved ionic conductivity, compatibility and charge–discharge behavior than the uncoated membrane. The permselective property of the POP coated membrane significantly reduced the self-discharge of Li–S cells even after 110 h which is superior to earlier reports.
Keywords: Lithium-sulfur batteries, Polysulfides, Covalent organic frame works, Permselective.

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Sonochemical Synthesis of G-C_3N_4/MnO_2 Composite for Photoelectrocatalytic Application

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The present study focus on the ultrasound assisted synthesis of graphitic carbon nitride (g-C_3N_4)/manganese oxide (MnO_2) composite nanocatalyst for photoelectrocatalytic (PEC) degradation of environmentally hazardous contaminants. The sonochemical synthesis aid in tailoring the morphology of g-C_3N_4/MnO_2. SEM/FESEM, XRD, FTIR, DLS, PL spectra, BET, etc. revealed on the crystallinity and photoelectro-intrinsic properties. The synergy of g-C_3N_4 and MnO_2 result in rapid electron transfer, efficient visible-light absorption and slower electron-hole pair recombination. The as-synthesised composite is proved efficient in decontamination of environmental samples that foster a fit-for-purpose and reliable composite.
Keywords: Graphitic carbon nitride, Manganese oxide, Photoelectrocatalysis, Sonochemical.

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Pseduocapacitve Properties of Copper Oxide Nanoparticles Synthesized via Microwave Method

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This paper discusses results obtained on copper oxide nanoparticles synthesized through simple microwave method by changing the concentration of the surfactant (Sodium Dodecyl Sulphate). The morphology and structure of the samples were examined through SEM, XRD and FTIR analysis. The electrochemical performance of the copper oxide samples was

investigated via cyclic voltammetry, charge- discharge and electrochemical impedance analysis using 1 M NaCl neutral electrolyte. A specific capacitance of 303 F $g^{-1}$was obtained at a scan rate of 2 mV s^{-1}. From EIS analysis, low charge transfer resistance of 3.28 Ω was obtained for C3 electrode (0.5M SDS). Based on the electrochemical performance and ease synthesis method indicate that the prepared copper oxide electrode is suitable candidate for supercapacitor applications.

Keywords: Metal oxides, Neutral electrolyte, Charge transfer resistance, Specific capacitance.

ABICNAN2019100363

Selective Detection of Methyl Parathion Using Carbon Nanotube-Based Devices in Soil and Rice Samples

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Semiconducting single-walled carbon nanotubes (s-SWCNTs) promise to advance a number of next-generation technologies. Of these applications, they are particularly attractive for uses in chemical sensors for environmental and health monitoring. Similarly, pesticides usage in the agricultural field is a rising issue of recent decades due to food, soil, air and water contamination. It was estimated that world-wide one million people per year get affected by chronic diseases and deaths from pesticide contaminated foods. Therefore, the seminal importance of detecting pesticides for point-of-care tests has driven the search for more sensitive, selective, stable and simple configured chemical sensors.

Keywords: semiconducting SWCNTs, Chemical sensor, Methyl parathion detection, Real sample analysis.

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Electrochemical Studies on SiO_x/Si/C Nanocomposite as Anode Material for Lithium Batteries

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The development of anode is an essential part of the lithium battery system because the stability of the anode determines the long-term cycle stability. Silicon monoxide and its suboxides (SiO_x) are promising anode materials which have attracted special attention recently due to its high specific capacity and improved cycling performance, with some similarities to Si anodes. The lithium-storage properties of Si/SiO_x/C nanocomposite electrodes were investigated in different electrolyte systems through cycling studies.

Keywords: Lithium Batteries, Silicon, SiOx, Anode, Electrolyte Additives.

ABICNAN2019100366

Effect of Gd^{3+} Substitution in Magnetic Hyperthermia and Proton Relaxation of Cobalt Ferrite Nanoparticles

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In this study, Gadolinium substituted Cobalt Ferrite nanoparticles ($CoFe_{2-x}Gd_xO_4$, $0 \leq x \leq 0.4$) were prepared via hydrothermal route using triethylamine as reducing agent at 180°C for 12 hours. X-Ray diffraction studies revealed the single phase cubic spinel structure of Cobalt ferrite and Gadolinium substituted Cobalt Ferrite nanoparticles with $x \leq 0.24$. Further with increase in the molar concentration ($x > 0.24$), gadolinium oxide is observed as the secondary phase, also confirmed by the Gd-O stretching vibrations observed in Fourier transform Infrared spectroscopy. Field emission scanning electron microscopy revealed that Cobalt ferrite and Gadolinium substituted Cobalt Ferrite nanoparticles ($x \leq 0.24$) nanoparticles are spherical in nature with particle size ranging from 10 to 25 nm, whereas the particle size increases above 30 nm for Gadolinium substituted Cobalt Ferrite ($0.3 \leq x \leq 0.4$) nanoparticles along with the presence of needle shaped particles. Magnetic measurements confirmed the ferromagnetic nature of Cobalt Ferrite and Gadolinium substituted Cobalt Ferrite nanoparticles and also revealed that the remanant magnetic field and magnetic saturation decreases with increase in gadolinium concentration. The surface charge and particle size of Cobalt Ferrite and Gadolinium substituted Cobalt Ferrite nanoparticles were studied. Further the specific absorption rate and magnetic hyperthermic potential of Cobalt Ferrite and Gadolinium substituted Cobalt Ferrite nanoparticles were investigated.

Keywords: cobalt ferrite, gadolinium oxide, hyperthermia.

ABICNAN2019100367

Green Synthesized Nickel Sulphide (NiS) Nanoparticles Dispersed in PVA matrix – Enhanced Dielectric Properties for Energy Storage Applications

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Nickel sulphide nanoparticles (NiS NPs) have been synthesized using a green synthesis approach. These synthesized NiS NPs with different loadings (0-3 wt%) were incorporated into polyvinyl alcohol (PVA) matrix to form PVA/ NiS nanocomposite films using a simple and cost-effective solution casting method. The characterizations and the properties of the PVA/NiS nanocomposite films were ascertained using FTIR, XRD, TGA, SEM and AFM. Further, the dielectric properties of PVA/NiS nanocomposite films have also been investigated at different frequencies (50 Hz–20 MHz) and at different temperatures (40 to 140 °C). The obtained results suggest that the homogenous dispersion of NiS NPs in the PVA matrix resulted in an excellent interaction between the polymer and the nanofiller leading to enhanced dielectric properties which are useful for electrical energy storage device applications.

Keywords: NiS NPs, PVA, Structural, Thermal, Dielectric properties.

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New Hierarchical Cerium(III) Sulphate Nanoflowers Decorated Reduced Graphene Oxide for Electrochemical Vitamin-C Sensor

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In this study, cerium sulphate nanoflowers {$Ce_2(SO_4)_3$} decorated reduced graphene oxide (rGO) was synthesized through a rapid one pot hydrothermal method. The crystal structure and morphology of the as-prepared nanohybrid composites were characterized using X-ray diffraction (XRD), field-emission-scanning electron microscopy (FESEM), Raman spectroscopy and Fourier Transform Infrared (FT-IR) spectroscopy. The electrochemical performance of the novel rGO/$Ce_2(SO_4)_3$ biosensor was investigated via cyclic voltammetry. The biosensor was evaluated for Vitamin-C (Ascorbic Acid, AA) detection and exhibited a wide linear range of 100 to 600µl, and also efficient to sense a low detection limit.
Keywords: Nanostructures, rGO, Cerium(III)Sulfate, Hydrothermal synthesis, Vitamin-C.

ABICNAN2019100375

Fabrication of Metal Molybdate/PANI-Ppy Nanomaterials for Electrochemical Supercapacitor

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In this work, Ag_2MoO_4 micro cubes, PANI-Ppy and its nano hybrid were synthesized by microwave, chemical oxidation methods. Synthesized Ag_2MoO_4/PANI-Ppy were utilized for the fabrication of working electrode and observed its electrochemical properties for supercapacitors (SCs). The Ag_2MoO_4/PANI-Ppy micro cubes exhibited a higher specific capacitance and better cycling stability, which were may attributed to their large surface area and high electrical conductivity. The specific capacitances were 264 F/g at current densities of 1 A/g, respectively. After 1000 cycles, the Ag_2MoO_4 micro cubes still displayed a high specific capacitance. These results implied that the hierarchical Ag_2MoO_4/PANI-Ppy nanohybrids could be a promising candidate for use as high-performance SCs.
Keywords: Silver molybdate, nanohybrid, micro cubes, electrode material, supercapacitors.

ABICNAN2019100376

Application of Optimization Techniques to Predict the Thermal Conductivity of Cu Based Nano Fluids and its Synthesis Using Two Step Method

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Modelling fuel cell characteristics is extremely important since it provides deep insight on its operating characteristics and help in design, analysis and development of high efficiency fuel cell systems. At the same time, modelling PEMFC system is limited by its complexity, strongly coupled behavior and multivariate characteristics. On the other hand PEMFC system operates at its maximum efficiency when functioned within its temperature limits. Otherwise membrane dryness occurs causing poor ionic conductivity and finally hampers the system. Hence modelling along with thermal management in PEMFC systems assumes significance. Hence, in this work fuel cell modelling along with performance enhancement is made via identification of Thermal conductivity via optimization techniques.

Keywords: Proton Exchange membrane fuel cell, Parameter extraction, performance enhancement, Flower Pollination algorithm, Nano fluid.

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A Density Functional Theory and Experimental Study of CO_2 Reduction to Methanol Over α-Sulfur-TiO_2 Composite

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The α-sulfur-TiO_2 composite is reported as an efficient catalyst for photoelectrocatalytic CO_2 reduction into methanol production. The α-sulfur-TiO_2 composite showed smaller particle size, homogenous sulfur distribution, high absorbance in visible light range, and photo-response to visible light. The α-sulfur-TiO_2 composite produced methanol at the rate of 17 mM/hr around two times higher than the α-sulfur catalyst. The higher catalytic activity was attributed to the reduced bandgap, higher electron-hole lifetime due to d to p orbital electronic transition, higher light absorbance in the visible region, and faster electron transfer.

Keywords: α-sulfur TiO_2, SEM, photoelectrocatalytic CO_2 reduction.

ABICNAN2019100379

Red luminescence in Europium Fluoride – Holmium Modified with Alanine (EFHA) Nanoparticles

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Holmium doped EuF_3 nanoparticles have been synthesized in presence Alanine using wet chemical method. EFHA belongs to hexagonal phase with a = b = 6.980 A^0 and c = 7.312 A^0.Debey-Scherer particle size estimated from XRD analysis is 42.79 nm. TEM analysis shows formation of assorted size nanoparticles consisting of hyperboloids, star shaped structures with some instances of globular aggregates. Rings in SAED pattern remain confined in the XRD analysis. Multiple peaks below 400 nm indicate formation of quantum dots. Comparative structural analysis of FTIR and FT-Raman has been carried out. The PL spectra shows intense peak at 654 nm (red) due to $^5D_0 - {}^7F_3$ transition.

Keywords: Surface Modification, Room Temperature, Co-precipitation, Flakes, Quantumdots.

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One pot In Situ Synthesis of Zns-$ZnIn_2S_4$ Composite for Improved Photocatalytic Applications

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Considerable interest has been shown in recent years towards utilizing semiconductor materials as photocatalyst in degradation of harmful contaminants in water. $ZnIn_2S_4$, as one of the ternary metal chalcogenides with bandgap in the visible region ranging between 2.3eV – 2.8 eV, is being looked upon by researchers for various applications in photocatalysis. Present work discloses the one pot synthesis of ZnS-$ZnIn_2S_4$ composite through hydrothermal route. The composite was characterized using X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and Diffuse Reflectance Spectroscopy (DRS). Direct sunlight driven photoactivity of the composite was utilized for organic dye degradation and photoelectrochemical measurements.

Keywords: Hydrothermal synthesis, Photocatalytic degradation, Photoelectrochemical measurement, Rate constant, Microcluster.

ABICNAN2019100385

Effect of Incorporating Alumina in Flexible Polyurethane Foam Composites on Mechanical and Physical Properties

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Polyurethanes (PU) are versatile polymers which can be molded to any shape. Reinforcing suitable micro and nano particles in the PU foam enhances its comfort, warmth and convenience to the consumer products. PU foams have versatile application due to its commendable comfort and insulation properties. Challenge for the foam is its strength, in the present work strength of PU foam is increased by reinforcing alumina to it. For the weight fraction of 1-35% of alumina, maximum increase in tensile strength and modulus of 35% was obtained. X-ray diffraction, SEM analysis and sol fraction of the composite was carried out.

Keywords: PU foams, nano alumina, SEM, sol fraction.

ABICNAN2019100388

Analysis of Luminescence, Morphological and Thermal Behaviour on Conjugated Polymer/CdS Electrospun Nanofiber

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Electrospun nanofibers of three series were prepared using different polymers (P1, P2, P3) and cadmium sulfide quantum dot. The diameter of the composite nanofiber was 80-100 nm from

SEM and 66-213 nm from TEM analysis. Collective arrangement of spider weblike morphology was observed for all nanofibers. Deviations of absorption andphotoluminescence was monitored and significant blue shift was found after doping CdS and PVA. It was found that the changes in PL spectra of polymers originated from the chemicalinteractions between polymer and CdS. The diameter of nanofiber composite was observed as127-347 nm from SEM analysis and 66-213 nm from TEM analysis. Thermal stability of these composite nanofibers was achieved up to 500 °C. Compared with pure polymers and CdS, present nano fibers were good thermal stability, apparent blue shift with bluish emissionwhich is suitable for optoelectronics application.

***Keywords*:** Composite, nanofibers, polyvinyl alcohol, luminescence, conjugated polymer.

ABICNAN2019100393

Fabrication of Ordered Silicon Nano-Horns via Silica Nanosphere Lithography Technique

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Here in we report a versatile and facile method for the fabrication of silicon nanohorns (SiNH's) using metal nano-gap template on silicon (Si) surface. 2D silica monolayer is used to develop the template for creating nanohole which enables the controlled etching and generation of silicon nanohorns via metal-assisted chemical etching. By varying the etching time SiHWs with desirable length could be obtained. The orientation of SiNH's is determined by the sputter silver film over the Si substrate, and an axis of the nanohorns is mostly along the ⟨100⟩ route. This nanostructure will surely improve the absorption of light and is a promising technology for low-cost optical devices, sensors, hydrogen evolution and MEMS by substituting the costly technique.

Keywords: Silica monolayer, Sintering, Non-close pack, Silicon Nano-horns.

ABICNAN2019100394

Indium-Free Large Area Spray-Deposited Nanocrystalline Nb-doped SnO_2 Thin Film as An Alternative Transparent Conducting Electrode

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Large area (10 x 10 cm^2) Nb-doped SnO_2 (NTO) thin film has been spray deposited and investigated by several analytical techniques. The transmittance of the film was 75 % at 550 nm. Electrical resistivity of 1.69 × 10-3 Ω cm and a lowest sheet resistance of 26 Ω/cm is achieved due to Nb dopant in the film. Variation of sheet resistance across every 1 x 1 cm^2 surface area and thermal stability were measured using four-probe method. The obtained results of NTO film indicates its suitability as an alternate indium free TCO for various applications.

Keywords: Spray pyrolysis, transmittance, Sheet resistance, Surface work function.

ABICNAN2019100400

Experimental Investigation of Nano Al_2O_3 Mixed Vegetable Oil as Coolant for Textured Tools in Turning Process

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In manufacturing industry, machining process and its environmental effect analysis are very important for enhancement of sustainability analysis. In turning process, the heat is generated due to friction, and this heat can be removed by the application of cutting fluid. The cutting fluid serves as an agent to cool the cutting tool the cutting tool and lubricates between the tool-chip and tool-work piece interface, but it also produces environmental pollution and other operator health issues. To overcome this issue, some research works are focused with different types of textured surface on turning cutting tool inserts on rake surface for improvement of sustainability improvement. The application of solid lubricant on textured surface is observed to provide lubrication effect on rake face. But few issues are with solid lubricants in the form of supply and quantity. Hence, in the present work is focused on the application of nano powder mixed vegetable oil (coconut oil) as coolant for textured cutting tool inserts on turning process and the results are compared with solid lubricant applied textured tool. The result is concluded that improved machining performance with nano powder mixed vegetable oil as coolant than solid lubricant textured tool inserts. The results of the investigation revealed that these machining characteristics are important to find the sustainable machining performance effectively.

***Keywords**:* Turning, Cutting tool, Texture, solid lubricant, vegetable oil, nano Al_2O_3

ABICNAN2019100401

Radial Heterostructure of MgO Core / ZnO Shell for Hydrogen Gas Sensor Application

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Hydrogen gas sensing characteristics of MgO nanocubes and ZnO decorated MgO nanocubes are studied on transparency sheet as substrate. MgO nanocubes and ZnO coated MgO nanocubes were prepared chemical vapor deposition and drop coating method respectively. The samples were characterized by XRD, SEM, EDAX and FTIR spectrum. The sensor responses were characterized under hydrogen gas for different concentration 3000, 4000, 5000 ppm at constant temperature. The response in resistance indicates that 1 molarity of ZnO coated MgO shows high sensitivity. Different flexible bending positions of device response were studied. Device shows the considerable response even at bending angles.

Keywords: Heterostrcture, Nanocube, Hydrogen, Gas sensor.

ABICNAN2019100404

An Insight into Ionizing Radiation Shielding Materials

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The ionising radiations are emitted by nature due to cosmic phenomena and nuclear reactions occurring during nuclear and industrial applications. There is a need for producing efficient shielding materials and to understand the interaction of the radiation with the shielding material. Several investigators have studied the application of nano filler materials like carbon nanotube (CNT), nano particles of gadolinium oxide, nano-h-BN particles etc in different matrix materials to produce, for example, composites and glasses. Different types of concretes with customized filler and matrix materials for shielding from ionising radiations like gamma rays has been reported in literature. This paper tries to review the various materials and processes that are commonly involved in making shielding materials in critical applications.
Keywords: ionising radiation, nano fillers, matrix, composite, shielding.

ABICNAN2019100414

Enhancing the Performance of Bulk Heterojunction Organic Solar Cell with Higher Hole Current Density by Varying Annealing Temperature of ITO film

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We fabricate the hole-only devices and P3HT:PCBM based heterojunction organic solar cells (OSCs) based on ITO anode annealed at different temperatures. The 400ºC annealed ITO based devices exhibit the improved performances due to decreased barrier height. The spin-coated PEDOT:PSS onto annealed ITO film improves the transparency in the visible region and also smoothens the surface morphology. The crystallite size of the ITO and ITO/PEDOT:PSS films increases with increasing annealing temperature of ITO, showing the decreased dislocation density and lattice strain. The 400ºC annealed ITO based OSC exhibits the higher efficiency (1.69%, 7.4mA/cm2, 0.54V and 0.42 (FF)).
Keywords: ITO, Annealing, OSCs, Improved efficiency.

ABICNAN2019100417

$Ba_2In_2O_5$ Based Photoactive Heterostructures for Environmental Applications

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$Ba_2In_2O_5$ an oxygen deficient brownmillerite structured material is synthesized through effective solution combustion method. The structural analysis and the morphological study were performed using XRD and SEM respectively. UV-DRS is used to evaluate the optical

bandgap of the sample. Structural and functional group information of the samples were determined through Raman and FT-IR spectroscopy. Further the photoactivity was experimented with photo degradation of the pollutant by using the $Ba_2In_2O_5/TiO_2$ composite as photocatalyst. The observed results were analysed and compared with each other.
Keywords: Brownmillerite, $Ba_2In_2O_5$, Composite, Photocatalyst.

ABICNAN2019100420

Study of Influence of PANI on Graphene in Supercapacitor Electrodes

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Supercapacitor electrodes were prepared using graphene and PANI nanocomposites. Graphene and PANI were prepared using modified Hummer's method and conventional chemical method respectively. The graphene was characterized using, Raman spectrum, XRD, SEM, UV-visible spectroscopy and PANI was characterized using UV-visible spectroscopy, SEM. Electrodes were prepared by taking different concentrations of PANI mixtures such as 5%, 10% and 15% with graphene. The electrochemical measurements were carried out for these electrodes. Results showed that sample with the 15% PANI did not behave like an efficient Supercapacitor electrode, whereas sample with 10% PANI showed considerable improvement in the supercapacitor characteristics.
Keywords: Graphene, PANI, Supercapacitors, Electrodes.

ABICNAN2019100421

Synthesis and Characterizations of Vanadium Pentoxide Filled Polypyrrole/Polyvinyl Alcohol Blend Nanocomposite Films as Chemiresistive Gas Sensors

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Novel polypyrrole (WPPy)/polyvinyl alcohol (PVA)/vanadium pentoxide (V_2O_5) nanocomposite films were successfully synthesized by solution casting method. The structural, optical and thermal properties of the synthesized PVA/WPPy/V_2O_5 nanocomposite films were investigated using Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), UV-vis spectroscopy (UV), scanning electron microscopy (SEM), atomic force microscopy (AFM), thermogravimetric analysis (TGA) and tensile tests. The sensing properties were evaluated to ascertain the effects of V_2O_5 on the sensitivity, selectivity, and response/recovery time of PVA/WPPy/V_2O_5 nanocomposite films.
Keywords: V_2O_5, PVA, WPPy, Chemiresistive gas sensors, nanocomposites.

ABICNAN2019100424

Photo-Electrochemical Characteristics of Electrodeposited Cuprous Oxide with Protective over Layers

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Photoelectrochemical performance of cuprous oxide (Cu_2O) and the role of protective over layers to inhibit photo-corrosion and subsequent enhancement in stability is investigated. Cu_2O films obtained by electrodeposition, showed good photo response with current density of 1 mA/cm^2 at -0.1 V vs RHE. As an inhibitor to photo-corrosion, over layers of Al (2%):ZnO and NiO_x are chosen. Photocurrent degradation of 3.5%, 0.16% and 0.03% is observed in Cu_2O, Cu_2O/AZO, and Cu_2O/NiOx photocathodes respectively. EIS measurements were conducted to investigate the electrode charge transfer kinetics it reveals that Cu_2O/NiOx exhibit faster charge transfer and minimum photocurrent degradation as compare to the Cu_2O/AZO and Cu_2O electrodes.

Keywords: Photo-electrochemical cell (PEC), photo current, cuprous oxide, protective over layer, electrochemical impedance spectroscopy.

ABICNAN2019100425

Hydrothermal Synthesis of Silicion Nanospheres Embedded on Carbon Nanotubes for High Performance Lithium-Ion Battery

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In the present work, we report the hydrothermal synthesis of silicon nanosphere (SiNs) embedded on the surface of carbon nanotube (CNT). In brief, SiNs were synthesized by reduction of silicon tetrachloride ($SiCl_4$) in molten salt of aluminium chloride ($AlCl_3$) and magnesium (Mg). For the fabrication of Si-CNT, as prepared SiNs and CNT were treated with hydrothermal method (T=200°C, 10 hr). The structure and morphology were characterized by X-ray diffraction (XRD), FE-SEM and Raman spectroscopy. A high specific capacity of 2169 mAh/g at current density 8.54 µAh/g with reversible capacity of 186 mAh/g was observed for the first cycle.

Keywords: Silicon nanoparticle, Carbon, Nanotube, hydrothermal, and lithium ion battery.

ABICNAN2019100426

Flexible and Binder-Free MoO3/Ti Thin Films as an Anode Material for High-Performance Supercapacitors

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In this work, flexible and binder-free MoO_3/Ti electrode was fabricated by RF magnetron sputtering technique followed by thermal treatment at 350 ℃ under various atmosphere. The microstructure and surface morphology of the MoO_3/Ti electrode electrodes were characterized by X-ray diffraction (XRD) and field emission scanning electron microscope (FE-SEM). Binder-free MoO_3/Ti was tested as electrode materials for supercapacitors in 05 M Li2SO4 by

cyclic voltammetry (CV), galvanostatic charge/discharge (GCD) and electrochemical impedance spectroscopy (EIS). The results obtained showed that MoO_3/Ti electrode displayed good electrochemical performance including specific capacitance in 0.5 M Li_2SO_4. These results suggest that the fabricated negative electrode has great potential as a power source for flexible and wearable electronic devices.

***Keywords*:** Flexible, Binder-free, MoO_3, Pseudocapacitive, Sputtering.

ABICNAN2019100429

Magnetic Study of $MnFe_2O_4$ Nanoparticles and $MnFe_2O_4$/Graphene-Oxide Nanocomposite

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$MnFe_2O_4$/graphene-oxide nanocomposites are synthesized using a facile hydrothermal technique. The formation and structural investigations are carried out with XRD, Scanning electron microscopy and Raman spectroscopy. Temperature, as well as field dependent magnetic measurements, have done over a wide temperature range (10 to 300 K) and magnetic field (± 5000 Oe) with the VSM probe of Physical property measurement system (PPMS) both under ZFC and FC conditions. The magnetic results for both nanoparticle and nanocomposite are discussed based on average anisotropy energy and coupling interactions.

Keywords: $MnFe_2O_4$ /GO nanocomposite, Hydrothermal method, Magnetic studies.

ABICNAN2019100434

Influence of Probe Amplitude on the Prepration of Graphene Scroll by Probe Ultasonicator Technique

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The graphene scroll is new material that influences the future applications. It is difficult to prepare the graphene scroll. Graphene scroll preparation was done using probe ultrasonicator with the mixture of ethanol and water. The prepared material was characterized. Graphene scroll is confirmed by Transmission Electron microscopy. Absorption and Transmission spectrum was recorded of graphene respectively using UV-Visible spectrometer and Fourier Transmission infrared Spectroscopy. EDAX confirmed the elemental analysis. Raman spectrum proves the prepared material is graphene. Formation of graphene scroll mechanism was analyzed.

Keywords: Graphene scroll, probe ultrasonicator, Raman spectrum.

ABICNAN2019100436

Synthesis, Characterization and Study of Optical and Electrical Properties of Nanostructured CuS Thin Films.

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The CuS thin films were synthesized on glass substrate through vacuum coating method followed by the interaction of H_2S gas with nanostructured Cu films at different temperatures. The EDX analysis of the thin films showed that the films are near stochiometric. The XRD analysis of the deposited thin films showed that the films are single phase covellite CuS, possessing hexagonal structure in good agreement with the JCPDS card no: 06-0464.The values of the crystallite sizes are in close proximity to the reported values. Surface morphology of the samples was studied using AFM. The very sharp Raman peak at 474 cm^{-1} was identified as the S-S stretching mode. The optical transmittance spectra analysis of the thin films showed that the films possess indirect optical band gap. The indirect optical band gap value determined from the optical transmittance spectra of thin film is 2.37eV. The film also exhibit good optical properties, which make it for application in photo-thermal conversion of solar energy. The temperature dependant dc conductivities of the nanostructured CuS films were studied over the temperature range from 303-373 K. From the Arrhenius plots of film samples, the activation energies were determined.

Keywords: CuS, H_2S, activation energy.

ABICNAN2019100438

One Pot Synthesis of Goethite (α-FeOOH) Nanoflakes for High-Performance Electrocatalytic Hydrogen Evolution Reaction

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Herein we report the controlled synthesis of goethite (α-FeOOH) nanoflakes via hydrothermal method, that exhibits highly efficient electrocatalytic activity towards the production of hydrogen. The obtained nanostructures were systematically characterized by XRD (X-ray diffraction), SEM (scanning electron microscopy) and FT-IR (Fourier transform infrared spectroscopy). The resultant α-FeOOH nanoflakes are immobilized upon screen-printed electrodes (SPEs) and exhibit Tafel slope value of 113 mV dec^{-1}. The HER activity displayed by the novel low cost α-FeOOH/SPE electrochemical platform, has potential to be a cost-effective alternative to Pt within electrolyser technologies.

Keywords: Chemical synthesis; α-FeOOH; Hydrothermal; Nanoscale; Water splitting, H_2 Energy.

ABICNAN2019100443

A Flexible Nanostructured SnO_2/CCY Electrode as a Sensor Platform for the Detection of Stress Biomarker

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This study examines the use of a conductive carbon fiber to construct a flexible bio- sensing platform for monitoring sweat biomarker cortisol. Flexible carbon yarns were deposited with nanostructured SnO_2 networks using hydrothermal method followed by the immobilization of specific anti-cortisol antibodies and used as an immuno sensing platform for electrochemical sweat cortisol detection. The crystallinity, structure, morphology, elemental and the surface area analysis were performed by using conventional analytical techniques. In its optimal conditions, the sensor was demonstrated a detection limit of 1.6 fg/mL with a wide linear range from 10 fg/mL to 1 μg/mL for the detection of cortisol using electrochemical DPV technique and the results were validated using commercial CILA method. The outstanding sensing properties of the prepared flexible immunosensor assured its potential in developing wearable healthcare monitoring devices.

Keywords: SnO_2 nanostructure, carbon fiber, flexible electrode, cortisol, sweat sensor.

ABICNAN2019100446

Quantum Dots for Biological Applications

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Protein conformational changes are associated with potential cytotoxicity upon interaction with small molecules or nanomaterials. Protein misfolding leads to protein-mediated diseases; thus, it is important to study the conformational changes in proteins using nanoparticles as drug carriers. In this study, the conformational changes in hemoglobin and thrombin were observed using fluorescence spectroscopy, circular dichroism spectroscopy and molecular modelling studies after interaction with non-toxic, water soluble near-infrared silicon quantum dot micelles. The molecular docking results indicated that the binding affinities of hemoglobin and thrombin with Si QD micelles are good.

Keywords: Silicon, Quantum dots, Molecular Interactions, Protein Dynamics.

ABICNAN2019100458

Effective Synthesis of Metal Loaded Nitrogen Doped Multi Walled Carbon Nanotubes for the Degradation of Congo Red Dye

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A simple and efficient way to synthesize metal loaded nitrogen doped bamboo shaped multiwalled carbon nanotubes (NBMWNT) by tubular furnace technique (TFT) using melamine as the single precursor for nitrogen and carbon, respectively and ferric chloride act as metal precursor for encapsulation of metal. The morphology, structure and size of NBMWNT were identified by x-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Raman spectroscopy. The iron filled hollow shaped bamboo CNT were clearly seen in TEM and Raman spectrum also suggest that the obtained CNTs are multiwalled with well graphitization. The analyzed samples were tested

towards the photocatalytic efficiency of Congo Red(CR) dye. Photodegradation efficiency shows Fe/NBMWNT could act as a good photocatalyst. To enhance the efficiency of photocatalyt different reaction parameters such as catalyst concentration, pH, H_2O_2, and initial concentration of dye were investigated.

Keywords: Nitrogen doped BMWNT, Tubular Furnace, Melamine.

ABICNAN2019100459

Improved Properties of Lead Halide Sourced Indium Doped $CH_3NH_3PbCl_3$ Perovskites

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The properties of hybrid perovskites can be improved greatly by tuning the precursor salts and process parameters. Herein, indium doped methylammonium lead chloride ($CH_3NH_3PbCl_3$) perovskites have been synthesized using halide sourced precursor salts for both the metal ions. All the samples are characterized using XRD, DRS-UV-Vis spectrometer and FEG-SEM. The obtained properties such as average crystallite size, lattice strain, dislocation density, bandgap, and morphologies are compared with the reported works of indium doped $CH_3NH_3PbCl_3$ perovskites prepared from non-halide source of lead. These properties are enhanced due to the simple change in lead source in comparison to the available literature. It has been observed that the above mentioned properties are enhanced due to the simple change in starting material.

Keywords: Hybrid perovskites, pin holes, lattice strain, urbach tail.

ABICNAN2019100461

Synthesis, Characterization and Morphological Studies of Barium Titanate by Wet–Chemical Method

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Synthesis characterization and morphological studies of active tetragonal phase $BaTiO_3$ nanoparticles have been prepared by Sol gel technique. The prepared samples were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy(FTIR) (UV-DRS).In addition, the morphology of $BaTiO_3$ was investigated using Transmission electron microscopy(TEM). The tetragonal phase of the prepared $BaTiO_3$were confirmed by XRD and Raman spectra. This investigation revealed that $BaTiO_3$ with tetragonal phase showed higher photo catalytic activity

Keywords: Tetragonal $BaTiO_3$, Wet Chemical Synthesis, Sol Gel, Photocatalytic, 2D Nanostructure.

ABICNAN2019100464

The Role of Anchoring Groups in Ruthenium (II) Bipyridine Sensitized P-Type Semiconductor Solar Cells-A Quantum Chemical Approach

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Ru(II)-bipyridine complexes connected with p-type semiconductors are promising systems for photocatalytic applications like DSSCs. The photosensitizer-semiconductor interface-governed by the anchoring group is of vital importance for electronic properties of the systems as it determines long-term stability to the semiconductor surface through its binding ability and also effects hole injection from the dye to the semiconductor. In this contribution, the role of anchoring groups in Ru(II)-bipyridine sensitized p-type semiconductor solar cells have been addressed by quantum chemical calculations based on DFT and TDDFT. Based on these calculations, new anchors for p-SC with improved properties are proposed.
Keywords: Density Functional Theory, Ru (II) bipyridine complex, Anchoring Groups, NiO.

ABICNAN2019100466

Cost Effective Counter Electrode (W- doped VO_2) for Dye Sensitized Solar Cells

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On using the Tungsten doped mesoporous VO_2 as the material for the counter electrode we can have many added advantages, the material has a low phase transition temperature of about 48C, this type of material will regulate the amount of radiation that is passing through it thereby maintaining a temperature control induced by the incident photons over the DSSC. In Subashini et al. The usage of VO_2 carbon coated material was used[1]. In Li et al the usage of W doped VO_2 as smart windows was used. We are trying to find out whether W doped VO_2 can perform as a better counter electrode so that smart windows application can also find its way into the DSSC.

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Functionalized Magnetic Nanoparticles for Cancer Therapy: A Robust Drug Delivery

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The functionalized magnetic Nanoparticles were prepared by solvo-thermal method in order to obtain the controlled size. The obtained nanoparticles were PEGylated resolute as functionalized nanoparticles are used as the nano-carrier were conjugated with the doxorubicin (DOX) which exhibits good drug loading efficiency. The characterization studies such as Scanning electron microscopy (SEM), X-Ray diffraction spectroscopy (XRD), Vibrating Sample Magnetometer (VSM), Fourier transform infrared spectroscopy (FT-IR) and Photoluminescence (PL) spectroscopy to be done to determine the size, shape, structure, interactions and binding of the nano-carrier and the drug molecules. Finally, the drug loaded nanoparticles will be bounded by the temperature sensitive hydrogel poly (Nisopropylacrylamide) to analyse the effect of temperature and pH for the drug release in the

cancerous cell; the physically targeted drug delivery will be achieved. The in-vitro studies to be made on the MCF-7 breast cancer cell to determine cytotoxic effect on the drug delivery using nano-carriers comparing with the unconjugated drug molecules.

***Keywords*:** Functionalized Magnetic Nanoparticles, DOX, poly (Nisopropylacrylamide), MCF-7 breast cancer cell lines.

ABICNAN2019100471

Squeezing Properties of Nonlocal Photon Added Continuous Variable Trimodal Coherent States

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The basis of quantum information theory is the manipulation of nonclassical states exhibiting properties incompatible with any classical theory. The continuous variable tripartite state is constructed using Glauber coherent states and all the three modes are excited using bosonic creation operators. The straight forward way of creating such nonclassicality is due to the addition of photons to Gaussian states. Surprisingly when we add photons to the Gaussian states, the states exhibit squeezing properties. The nonclassicality introduced in three modes had been measured through single mode squeezing, higher order squeezing and intermodal squeezing. Our proposed work is to induce nonclassicality through nonlocal addition of photons.

Keywords: Coherent state, tripartite coherent state, nonclassicality.

ABICNAN2019100478

Effect of Bovine Serum Albumin on Tartrate-Modified Manganese Ferrite Nano Hollow Spheres: Spectroscopic and Toxicity Study

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The interaction of bovine serum albumin (BSA) with magneto-fluorescent tartrate modified $MnFe_2O_4$ nano hollow spheres (T-$MnFe_2O_4$ NHSs) suggest that the interaction occurs by an electrostatic mechanism. BSA enhances the charge transfer transition from the ligand to the metal ions. A salt bridge formation occurs between the lysine of the BSA surface and the tartrate at pH 10, followed by pH 3 and pH 7, respectively. Fluorescence microscopic analysis reveals that BSA significantly enhances the contrast of T-$MnFe_2O_4$ NHSs in UV and blue light excitation. *In vitro* and *in vivo* studies revealed that the sample is non-toxic.

Keywords: Tartrate modified $MnFe_2O_4$ nano hollow spheres, bovine serum albumin, ligand to metal charge transfer transition, *d-d* transition, fluorescence anisotropy.

ABICNAN2019100479

Investigation of ZnO Nanobranches Based Gas Sensors for the Detection of NO_2

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The design and development of array based gas sensors was studied in this work. An array is a single substrate which is modified using different modifiers in a way that are selective to certain gases in the atmosphere. In this study a ZnO nanobranches substrate was modified with Al, Ti and Au layers resulting in an array of 4 x 3 sensor films. Data repository was prepared using an indigenously developed data acquisition system, testing chamber and a Labview based program. The data bank is generated by recording the response curve of the sensor array towards NO_2, NO and H_2S as a function of gas concentration. A simple bar chart is used to identify the target gas. It indicates a unique signature pattern for the gases under investigation.

Keywords: ZnO Nanobranches, array, toxic gases, sensor response.

ABICNAN2019100480

Fe_2O_3 Integrated Conducting Polyaniline Hierarchical Nanocomposte as Non-Invasive Electrochemical Sensor Platform for Creatinine

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The present work describes the preparation of Fe_2O_3 integrated hierarchical polyaniline (PANI) nanofibers using facile synthetic route for the electrochemical detection of creatinine. The polymerization kinetics reveals the significance of oxidation potential and the pH of reaction medium. The physicochemical properties of the prepared Fe_2O_3/PANI nanocomposite are confirmed using the analytical techniques. The incorporation of conductive PANI matrices with Fe_2O_3 results in enhanced the charge transfer ability and active surface area of the nanocomposite. The electrochemical activity of Fe_2O_3/PANI towards creatinine was analysed using cyclic voltammetry and differential pulsed voltammetry and the outcomes showed remarkable sensitivity with notable anti-interference ability.

Keywords: Polyaniline, nanocomposite, self-organised, creatinine, electrochemical detection.

ABICNAN2019100482

Design of Bio-implantable Antenna using Metamaterial Substrate

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An implantable medical devices are used for continuous monitoring of health. An implantable antenna is hence an important element in the implantable device which is used to transmit signal. Thus, being helpful for continuous monitoring of health. Challenge for implantable antenna design are to achieve small size, large gain, wide bandwidth, omnidirectional radiation pattern and biocompatibility of antenna. The size of antenna depend on the permittivity and permeability of the substrate on which antenna is placed. So, this paper focuses using the metamaterial substrate thereby trying to minimize the size of an implantable antenna.

Metamaterial antenna is designed for ISM (Industrial Scientific and Medical band) band frequencies at 2.4GHz, 4.8GHz and 5.8GHz respectively. The size of antenna is in the origin of millimeter. The gain of antenna is increased up to -23.10dB.

Keywords: Metamaterial, implantable antenna, split ring resonator, biocompatible material etc.

ABICNAN2019100487

Influence of O_2 Flow Rate on the Characteristics of TiO_2 Thin Films Deposited by RF Reactive Sputtering

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Titanium dioxide (TiO_2) thin films were prepared by radio-frequency (13.56MHz) reactive sputtering onto glass substrate under different O_2 flow rates, keeping Ar flow rate constant. The effect of O_2 flow rate on the structural and optical properties of sputtered TiO_2 films was studied. X-ray diffraction (XRD) analysis of these films reveals the presence of anatase and rutile phases. The microstructural parameters such as lattice constant and average crystallite size were estimated from the XRD data and were correlated with the morphology and optical properties of the deposited TiO_2 films. Field emission scanning electron microscopy (FESEM) results exhibits a dense granular morphology and the particle size is found to decrease with increase in O_2 flow rate. The optical properties were studied by UV-Vis transmission and photoluminescence (PL) spectroscopy.

Keywords: TiO_2 thin films, Reactive sputtering, O_2-flow rate

ABICNAN2019100488

Tribological Performance of Engine Oil with Graphene Oxide Nano Additives on Cylinder Liner Honing Surface at High Contact Pressure

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Improving friction and wear characteristics of lubricants dispersed with nanoparticles is a major area of research. The effect of initial surface roughness on plateau honed cylinder liner with Graphene oxide nano particles dispersed in fully formulated commercially used SAE 20W50 diesel engine oil is studied on a reciprocating tribotester. Initial surface roughness is implanted on the engine liner surface for various reasons like reducing friction, surface contact, improving wear and seizure resistance. Engine oils with nanoparticles have shown improved friction and wear characteristics but with honed surfaces of engine liner at high contact pressure the anti-wear characteristics improved by 42% and coefficient of friction improves marginally.

Keywords: Plateau honing, roughness, nano additives, fully formulated engine oil, scuffing.

ABICNAN2019100490

Suppression of Lithium Dendrite by Triazine -Based Porous Organic Polymer Laden-PEO Based Electrolyte and its Application for All-Solid-State-Lithium Batteries

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Triazene*p*- phenylenediamine porous organic polymer (TP-POP) was successfully synthesized and incorporated as a filler in a PEO+LiTFSI matrix. The CPE membranes were characterized by several techniques including SEM, DSC, TGA as well as tensile studies. The electrochemical properties such as ionic conductivity, compatibility, dendrite studies were also investigated.

Key words: Porous organic polymer, Lithium dendrite, Ionic conductivity, Lithium transference number.

ABICNAN2019100493

Effect of Temperature Reaction on Chemically Synthesized ZnO Nanoparticles change in Particle Size

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Previously ZnO nanostructures production such as Hydrothermal, Co-operation and Anodization were described. In this paper FTIR, XRD, scanning electron microscope processes are used for determining various characteristics of ZnO particles. It shows morphological changes of ZnO particles. We presented the study of ZnO nanoparticles properties by using UVVisible spectrophometer, photoluminescence spectroscopy devices. It determines the properties of ZnO nanoparticles.

Keyword: ZnO nanoparticles, XRD, Scanning electron microscope, Fourier-transform infrared spectroscopy, Ultraviolet photo dectors, Photoluminescence.

ABICNAN2019100494

Performance Study of Integrated Anaerobic Baffled Reactor for Treating Institutional Wastewater

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A laboratory scale integrated anaerobic baffled reactor was fabricated for treating an institutional wastewater with five compartments with a working volume of 68.25 litres. Temperature of the reactor was maintained under mesophilic range. The reactor was accomplished with both suspended and attached growth processes. The OLR of this study was from 0.101 to 0.870 Kg COD/ m^3.days. The COD removal efficiency for the final set of experiment was achieved 77 % with an Influent COD of 696 mg/l decreased to 152 mg/l shown in Figure 4.31, 4.39 and 4.47. The maximum COD removal efficiency was achieved 77 % with an Influent COD of 696 mg/l without addition of co-digestion at an OLR of 0.137 kg COD/m^3.day.

Keywords: COD, Co-Digestion, Suspended growth process, Attached growth Process, Plexiglass.

ABICNAN2019100496

Electron Field Emission Prototype Demonstrator Utilizing Novel Pulsed Excimer Laser Irradiated Silicon Micro-Nano Emitter Arrays

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In this paper, we describe the technical development in the design and fabrication of a 32×32 lines diode (non-gated) configuration prototype field emission display (FED) demonstrator, fabricated using pulsed excimer laser irradiated silicon micro-nano electron emitter arrays. Self-aligned and randomly oriented conical micro-nano structures as high as 1 μm were fabricated. Best field emission (FE) results were measured from samples with the highest surface features with FE currents in the order of 10-6 A and low turn-on emission threshold of ~14 V/μm. In addition a theoretical investigation on field emission properties of triode (gated) silicon micro-nano electron emitters is presented. These investigations include studies on the effects of device geometry and internal electronic structure of the thin silicon films.
Keywords: Thin silicon films, excimer laser, field emission display, prototype, modelling.

ABICNAN2019100498

Cytocompatible Bi-Functional Nanoprobe for Intracellular Bio-Imaging and Herbaceutical Detection

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Multifunctional nanomaterial is an emerging thrust area in biomedical science for theranostics. Herein, we report bi-functional nanoprobe consisting of metal oxide, dye complex, and bio-polymer for intracellular imaging, therapeutics, and electrochemical transduction. Coordination chemistry between chitosan's amine group and MoO_3-Ru(II) extended the cytocompatibility and bio-imaging as observed *in-vivo* studies suggest it as excellent therapeutic and intracellular imaging probe. Similarly, the electrochemical transduction ability has been explored for herbaceutical (butein) detection, enabling high current density with linearity at ultralow concentration (5-1250 nM) and lowest detection limit of 28 nM. The proposed cytocompatible opto-electrochemical nanoprobe with inherent antioxidant may find multifunctional utility in oncological research.
Keywords: multifunctional nanoprobe, opto-electrochemical activity, bio-imaging, herbaceutical detection.

ABICNAN2019100499

Thermodynamic Simulation of H_2 – Metal Hydrides and CO_2 – Adsorbent Based Sorption Refrigeration System

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In the present work, the performance of H_2 – metal hydrides ($La_{0.9}Ce_{0.1}Ni_5$ and $LaNi_{4.7}Al_{0.3}$) and CO_2 – adsorbent (Activated Carbon and Pore Expanded Mesoporous Silica) based

refrigeration system are investigated and compared. The thermodynamic cycles for both the systems are analysed for temperature range of 0°C (cooling output), 25°C (heat sink) and 100°C (heat source). The main advantages of these types of sorption systems is its ability to work with waste heat as input and without moving parts. The system performance are cooling output, COP, specific alloy output and second law efficiency.

Keywords: metal hydrides, adsorbent, cooling system, COP, specific alloy output.

ABICNAN2019100500

Tempo-Oxidised Nanocellulose Stabilised Gold Nanoparticles for the Selective Colorimetric Detection of Cysteine

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In this study, a simple and highly sensitive colorimetric assay of cysteine using TEMPO-oxidised nanocellulose (TNCF) stabilised Au nanoparticles has been carried out. The results indicated that the introduction of cysteine could induce the aggregation of the AuNPs in presence of salt, displaying a visual color change from red to blue and shift in UV–vis absorption wavelength. This proposed method can determine cysteine over a linear range of 0.1µM to 30 µM with a detection limit of 0.01µM. Furthermore, this sensing system is applied for detection of cysteine in real biological samples and thus holds great promises in clinical applications.

Keywords: Gold nanoparticles, TEMPO oxidized nanocellulose fiber, Cysteine, Colorimetric sensor

ABICNAN2019100501

Removal of Heavy Metals from Industrial Effluent Using Cobalt Ferrite and Micro Organism

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Wastewater treatment were posed a big challenges to mankind and this problems were increasing more with the increase of populations and industrialization. In this study we used for treating industrial effluent for bio adsorption of selected heavy metals. The absorption capability of $CoFe_2O_4$ and the fungi were tested for two toxic metals chromium and zinc. FTIR characterization the higher frequency band generally observed in the range 550–600 cm−1, and the lower frequency band usually observed in the range 340–450 cm−1, are associated with stretching of the bonds between the metal ions and oxygen in the tetrahedral and octahedral sites. The absorption efficiency with respect to absorbent quantity, concentrations of absorbate was studied. The absorption kinetics of the substrate followed a heterogeneous mode of absorption of the heavy metals as it showed a higher R_2 value for the Freundlich isotherm kinetics. Cobalt ferrite nanoparticles significantly improved antibiotic assay against

Pseudomonas aeruginosa and *K.pneumoniae*. Cobalt ferrite were analyzed for MTT assay against breast cancer cell line with different concentrations and calculated LC50 value.

Keywords: Cobalt ferrite, *Trichoderma viride*, Potassium dichromate, zinc chloride, SEM-EDAX, Freundlich isotherm.

ABICNAN2019100502

One-Pot Synthesis of Cu@Rgo and Cu_2O@rGO for Enhanced Photocatalytic Reduction of Co_2 to Methanol

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In this work we have performed a photocatalytic reduction of CO_2 to methanol with the help of Cu and Cu_2O nanoparticle on graphene oxide as photocatalyst. Octahedral Cu_2O and metal Cu nanoparticles were synthesized and deposited on graphene oxide by one-pot synthesis method at room temperature. Cu-rGO catalyst with Cu nano particles of size of 5-7 nm deposited on graphene oxide sheet is significantly more efficient for CO_2 reduction to methanol than Cu_2O and Cu_2O-rGO. The combination of rGO should provide a platform for photogenerated electrons to transfer from conduction band of the photocatalyst. This work provides a facile route for synthesis and size control of Cu_2O nanoparticles on graphene oxide sheet as a visible light-active-photocatalysts for CO_2 conversion using sunlight.

Keywords: Graphene, Cu_2O, One-pot, shape-control, CO_2 reduction, Photocatalysis.

ABICNAN2019100505

Colorimetric Ion-Recognition Strategy Using Silica Monolith Platform: A Smart Initiative for the Rapid and Selective Detection of Cd^{2+} and Hg^{2+} Ions

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In this article, we manifest the possibility of a reversible solid-state naked eye colorimetric ion-sensor for the effective diagnosis and quantification of Cd^{2+} and Hg^{2+} ions, using a structurally designed mesoporous silica monolithic template conjoined with an indigenously synthesized ion-selective chromoionophoric probe namely, 4-hexyl-6-((5-mercapto-1,3,4-thiadiazol-2-yl)diazenyl)benzene-1,3-diol. The unique structural features and distinct analytical properties of the fabricated sensor proffers intense response in signalling the presence of ultra-trace target metal ions with remarkable selectivity and sensitivity. The stoichiometric complexation ratio of the probe molecules with the target metal ions has been evaluated by Job's plot. The influence of assorted analytical criterions such as pH, response kinetics, solution temperature, critical probe concentration, sensor quantity, matrix tolerance, linear response range, reusability, detection limit (LD) and quantification limit (LQ) has been analyzed to validate the sensor performance. The real-world efficacy of the sensor prototype has been tested with synthetic water samples to authenticate its data reliability and reproducibility.

Keywords: Monoliths, Mesoporous, Optical Sensors, Cadmium, Mercury.

ABICNAN2019100506

Thermal and Morphological Study of Graphene Based Polyurethane Composites

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Recently, the graphene polymer nanocomposite are highly influencing in the field like membranes, biomedical aids, electronics, actuators and sensors. This paper is to determine the morphological study of Polyurethane graphene composite was prepared by solvent casting method. Polyurethane graphene nanocomposite was fabricated with different weight percentages 2.5%, 5%, 10% graphene of polyurethane. Micro-structural phase change of the polymers composite was examined by x-ray diffraction (XRD). Through Scanning Electron Microscope (SEM) the morphological changes in the polyurethane graphene composite after homogeneous dispersion of nanofillers were analyzed. XRD, SEM and Fourier Transform Infrared Spectroscopy (FTIR) investigation has confirmed that there is no cross-linkage between graphene and polyurethane. From this study without any chemical reaction through solvent casting method homogenous dispersion of graphene in polyurethane matrix was initiated.

Keywords: Polyurethane, graphene, N, N-Dimethylformamide, solvent casting.

ABICNAN2019100508

$CuNb_2O_6/TiO_2$ Nanocomposite for Enhanced Photocatalytic Hydrogen Production

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Massive production of hydrogen by water decomposition triggered by a solar light active photocatalyst is a major objective in chemistry and a promising avenue to overcome the global energy crisis. The development of efficient, stable, economically viable and eco-friendly photocatalysts for hydrogen production is a challenging task. Here, we discuss the design, synthesis and development of Nb_2O_5-based nanocomposite photocatalysts for hydrogen production. Due to its wider band gap, the Nb_2O_5 cannot be an effective photocatalyst on its own. Tuning the band gap of Nb_2O_5 by several methods have been demonstrated earlier and only limited success was achieved. Thus, an attempt has been made to modify the surface and optical properties of Nb_2O_5 by Cu incorporation. The Cu_xO nanoparticle and Nb_2O_5 prepared using different methods were mixed together in an appropriate ratio using milling and subjected to heat treatment for the formation of $CuNb_2O_6$. The bare Nb_2O_5 showed a band gap of 3.4 eV and it requires high energy photons (UV-light) to act as photocatalyst. But, the prepared $CuNb_2O_6$ shows 1.9 eV thus it can act as good visible light photocatalyst. To accelerate the

photocatalytic hydrogen evolution, a $CuNb_2O_6$-TiO_2 nanocomposite has been prepared, where the $CuNb_2O_6$ acts as an efficient co-catalyst and injects excited electrons into the conduction band of TiO_2. The observed photocatalytic hydrogen production for the $CuNb_2O_6$-TiO_2 nanocomposite is 109 $mmol.h^{-1}.g^{-1}_{cat}$ which is significantly higher than the 30 $mmol.h^{-1}.g^{-1}_{cat}$ of bare $CuNb_2O_6$. In this presentation, the detailed synthesis, morphological, optical and photocatalytic studies will be discussed.

Keywords: Hydrogen production, Solar light, nanocomposite.

ABICNAN2019100509

Thermodynamic Simulation of Hydrogen Based Thermochemical Energy Storage System

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Thermal energy storage (TES) system based on gas-solid interaction is an effective technology to store energy during availability of renewable sources, and provides the same when sources are unavailable. The present work presents a performance analysis for Metal Hydride based Thermal Energy Storage System (MH-TES) which can transform the waste heat provided as input to useful high grade heat, thus opening doors for better waste heat recovery. The study employed experimental results as a pressure concentration isotherm (PCI) of metal hydrides and thermodynamic study using $La_{0.9}Ce_{0.1}Ni_5$ and $LaNi_{4.6}Al_{0.4}$ metal hydride pairs. The operating temperature conditions for MH-TES are 303K, 383K and 423K as ambient condition, waste heat input temperature and upgraded heat temperature respectively.

Keywords: metal hydrides, metal hydride based thermal energy storage, thermodynamic properties, PCI, hydrogen storage.

ABICNAN2019100512

Nanoparticles Combined with Cefixime as an Effective Synergistic Strategy against *Salmonella Enterica Typhi*

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Salmonella typhi is a Causative agent of Typhoid fever and most important health issue in rural people especially in Southeast Asia and Africa. *Salmonellosis* is a disease caused by a large group of bacteria of the genus *Salmonella*. This causes substantial economic loss resulting from mortality and morbidity. Silver, Nickel, Iron oxide, Aluminium and Zinc oxide Nanoparticles were used in this study along with cefixime. The antimicrobial assay showed silver, nickel, aluminium, iron, zinc nanoparticles presented good antibacterial performance against pathogenic *Salmonella* sp. The fold increase of Cef+NiNP is 64.07%, Cef+ZnNP is 54.38%, Cef+FeNP is 36.98 %, Cef+AgNP is 16.01% against pathogenic *Salmonella* sp. Compare to antibiotic alone.

Keywords: Cefixime, Salmonellosis, Nanoparticle, Nickel, Silver, Typhoid

ABICNAN2019100513

Fabrication of Biodegradable, Flexible, Ultrasensitive, Nanocellulose Based SERS Substrates for Trace Level Detection of Pesticides

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Surface enhanced Raman scattering (SERS) is a nondestructive and ultrasensitive detection technique that can identify molecules down to single molecule level based on their Raman fingerprints. Silver nanostructures has been widely explored in SERS due to its unique ability to scatter light and form localized surface plasmon resonance. The development of reproducible, stable and cost effective, SERS substrates is pre-requisite for widespread application of SERS based sensors. Nanocellulose based silver nanostructures in colloid form as well as on flexible substrates with good SERS sensitivity to a number of Raman active molecules below nano molar concentration is investigated.
Keywords: Nanocellulose, SERS, silver nanostructures, sensors.

ABICNAN2019100514

Influence of Nano Alumina Addition on the Properties of SiC Refractories

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The refractory industry is highly matured and in order to counteract the stiff competition from foreign market, the only way is to develop new technologies that have high added value and cannot be easily copied. Thus, the use of nanoparticles has brought about a revolution in refractories field by exhibiting remarkable performance. The objective of the present work is to study the influence of incorporation of sol-gel synthesised nano alumina powder to the matrix part of Silicon-Carbide refractories. Apparent porosity, bulk density, cold crushing strength, cold and hot modulus of rupture, modulus of elasticity, spalling resistance, abrasion resistance and fracture surface analysis through SEM have been evaluated for the nano alumina added (0.5 and 1.0 wt-%) into SiC bricks and compared with without addition of nano alumina. The obtained results shows an improved densification and better sintering upon addition of nano alumina powder due to better compaction by filling up the interior voids and pores between various SiC particles. Nano Alumina added SiC bricks shows high hot strength, high erosion and abrasion resistance and excellent thermal shock resistance at elevated temperatures and have potential applications in kiln furniture's.
Keywords: Nano Alumina, Thermal Shock, Kiln Furniture, abrasion resistance, Microstructure, Hot Strength.

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Site Specific Delivery of Green Tea Coated Aluminium Magnesium Silicate Beads and Studies their Anti- Coccidial Effect Against Chicken Coccidiosis.

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In this report, the site specific co- delivery of green tea/aluminium magnesium silicate (AMS) beads was reported. The specific target delivery was achieved through orally. The new co precipitation process was developed to synthesis the green tea/AMS complex and the EDX, FTIR and Raman confirmed its successful synthesis. The blood biocompatibity of the green tea/AMS was tested using chicken blood, and it the complex is safe up to 500 mg/ml. After coated with HPMC, the beads underwent different pH based dissolution studies and the size reduction was measured. The results indicated that, the beads specifically dissolved in gastric pH (6.5). The pharmaco kinetic studies were performed to estimate the delivery kinetics. The results revealed the beads underwent as per Higuchi model and the packing materials released through dissolution and diffusion mechanism. The anti cocidial effect was tested using chicken. The studies were performed in two categories such as prophylactic treatment and after coccidial challenge. The results indicated that the prophylactic treatment with green tea/AMS beads 100% protect chicken and the treatment with green tea/AMS beads after the coccidial challenge significantly protect the intestinal damage and enhanced the anti coccidial effect. In conclusion, the green tea/AMS beads offered promising protection against coccidiosis.
Keywords: Coccidiosis; green tea; Aluminium magnesium silicate; Delivery; Enteric coating; Hydroxyl propyl methyl cellulose

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Photochromic Properties of PLD-Grown Nanostructured MoO_3 Thin Film

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In the present work, we have studied PLD grown MoO_3 nanostructures (NS) for its Photochromic performance. MoO_3 NS were synthesized using PLD and characterized by XRD, Raman spectroscopy. CAFM studies were carried out on the MoO_3 nanostructures at constant bias. These studies revealed that MoO_3 NS exhibits enhanced photochromic response.
Keyword: PLD, MoO_3.

ABICNAN2019100517

Structurally Engineered Porous Polymer Monolithic Templates as Solid State Colorimetric Sensors for Copper Ions

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In this study we report on the superior ion-sensing capabilities of a new type of solid state optical sensor for copper ion detection in water samples, using porous polymer monolithic templates. The proposed monolith template design is a single block framework with uniform structural pattern and pore network. We report on the fabrication of two novel solid-state

polymer based Cu(II) sensors using two synthesized chelating ligands namely, 4-butyl-N-(2-(2,4-dinitrophenyl)hydrazine-1-carbonothioyl)benzamide (BNHCB) and 2-(thiophen-2-ylmethylene) hydrazinen-1-carbothioamide (TMHCA), as the probe molecules. The synthesized polymer monolithic materials are characterized using different surface and structural techniques such as HR-SEM, HR-TEM, EDAX, XPS, XRD, FT-IR, and BET analysis. The probe anchored polymer monoliths exhibits unique color transition for Cu^{2+} ions with selective and sensitive sensing possible down to ppb levels. The impact of various sensing parameters such as, solution pH, probe concentration, matrix tolerances, sensor material and response kinetics etc., has been optimized. The fabricated sensor materials had a maximum sensing ability at neutral sample pH conditions with a LD & LQ values of 0.90 & 3.01 µg/L (for BNHCB anchored polymer sensor), and 1.26 & 4.20 µg/L for TMHCA anchored polymer sensor, respectively. The proposed solid-state colorimetric sensors are environmentally benign, reusable and also cost effective with superior analytical performance.

Keywords: Polymer; Monolith; Sensor; Colorimetric; Copper; Regeneration.

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Natural Resource of Indian Ziziphus Mauritiana-Based Carbon Quantum Dots as a Novel Ammonia Sensory Probe

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A simple, economical, and green method for the preparation of water-soluble, highly fluorescent carbon quantum dots (CQDs) has been prepared via hydrothermal method using *Ziziphus mauritiana* as a carbon source. Synthesized CQDs were characterized by UV- visible, fluorescence, FTIR, XRD, and HR-TEM techniques. The prepared CQDs were spherical shape with an average diameter of 4 nm and shows bright bluish green emission properties. The fluorescence intensity of CQDs was effectively quenched in presence of ammonia as compared with other gaseous molecules in aqueous media. Hence, the synthesized CQDs can be used as fluorescent sensor for detection of ammonia even at low concentration.

Keywords: Ammonia, Fluorescence, hydrothermal, sensor, *Ziziphus mauritiana.*

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Polythiophene-PCBM-Based All-Organic Electrochromic Device: Fast and Flexible

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A fast and flexible all-organic electrochromic device, fabricated using polythiophene and PCBM as active materials and plastic substrate has been reported here. The device shows quantifiable improvement in electrochromic performance using parameters like switching

speed, coloration efficiency, color contrast, and cycle life. Spectroscopic investigations have been carried out using Raman and UV-vis to establish a bias induced redox switching based mechanism for reported improvement in the performance. The device shows switching between magenta (OFF) and transparent states (ON) with a very small bias of ±1 V, an optical modulation of 50% and an absorbance switching contrast of 91%. An enhanced stability for duration of longer than 2500 s and 250 cycles has been reported with an ultrafast response of few hundred milliseconds. A very high coloration efficiency of 321 cm^2/C is achieved, making the proposed device one of the best reported P3HT-based electrochromic devices.

Keywords: electrochromic, organic electronics, flexible devices, polythiophene, PCBM

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Design Of Graphene Nanostructure Based Cost Effective Hybrid Flexible Supercapacitor

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There is a need for solid-state devices with physical flexibility, will be a crucial advantage in modern electronic devices. High charge storage capacity increases its demand in energy storage and transport applications. Various forms of graphene with different morphologies help us achieve desired property to be prepared using the Hummer's method and the characterization studies such as the Raman spectroscopy to determine the molecular fingerprints of the materials and transmission electron microscopy for the morphology determination. The use of graphene in energy storage and transport has open up new field of flexible electronics. As graphene has high mechanical properties and surface to volume ratio there are various applications especially as cost effective flexible supercapacitors. These supercapacitors made were studied using the electrochemical workstation.

Keywords: Graphene, flexible supercapacitor, hummer's method, electrochemical studies

ABICNAN2019100522

Surface Polar Charges Induced Cds-Ni Heterostructure for Efficient Photocatalytic Hydrogen Evolution

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Simple chemical process synthesized CdS-Ni nanocomposites with Ni (1.0-4.0 wt%) was used for hydrogen evolution process. The results show that the CdS-Ni composite containing 1.0 wt% of Ni exhibits the highest H_2 evolution rate of 2.8 mmolh−1 with strong photo-stability, which is about four times higher than that of CdS. The increased photo-catalytic H_2 generation efficiency is attributed to the effective charge separation and decreased anti-recombination with the addition of Ni. The results pave a way to design multi-component CdS-Ni nano-composites for highly efficient H_2 generation and other applications.

Keywords: Cadmium Sulphide, Nickel, XRD, XPS, Photo Response

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Tungsten Oxide (WO_3) and Bismuth Vanadate ($BiVO_4$) Nanocomposite for Solar Water Splitting

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The tungsten oxide (WO_3) were fabricated by thermal decomposition method, with help of precursor Ammonium meta-tungstate (AMT). $BiVO_4/WO_3$ heterojunction, was formed by spin coating $BiVO_4$ on WO_3 surface. The number of layer in $BiVO_4$ and WO_3 substrate was varied. As prepared films were characterized by scanning electron microscopy (SEM), UV-vis absorption, x-ray diffraction (XRD), Photoluminescence (PL). Photoelectrochemical (PEC) tests like linear sweep voltammetry (LSV), electrochemical impendence spectroscopy (EIS), Mott-schottky analysis were performed for both WO_3, $BiVO_4/WO_3$ heterojunction structure. Finally, chronoamperometeric test was performed to check stability of photocatalyst.
Keywords: Thermal decomposition, tungsten oxide, spin coated, $BiVO_4$.

ABICNAN2019100525

Effective Adsorption of Congo Red Dye Using Chitosan and Zerovalent Iron Nanoparticles

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Current environmental issues emphasize the exploration of advanced materials and economical methods for purification of waste water. The present work focuses on using advanced composite material made up of chitosan, activated carbon, nano zerovalent iron nanoparticles (nZVI) in order to facilitate adsorption of Congo red dye. The various parameters such as effect of initial dye concentration, temperature, pH was studied. The optimum dye to adsorbent was analyzed. Box-Behnken design of experiments with three factors was used for optimization. The optimization studies are incorporated in order to investigate the relationship between the effects of the variables on the adsorption.
Keywords: Chitosan, Zerovalent iron nanoparticles, Congo red dye, Adsorption, Box-Behnken design.

ABICNAN2019100526

Novel Approach for Mitigation of Fouling and Sustainable Water Treatment Using Submerged Ceramic Membrane Bioreactor

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Water pollution control is necessary and exigent to ensure safe drinking water to the population all over the world. The present work focuses on treatment of industrial waste water using submerged ceramic membrane bioreactor (SCMBR). SCMBR is the cost effective and efficient process for water purification with a drawback of the fouling phenomena. The present work

emphasize on efficient mitigation of fouling using sodium alginate and iron nanoparticles composite. The composite used is found to be a very good aid in reduction of fouling and the system can be effectively used as efficient and ecofriendly solution for waste water treatment.
Keywords: Waste water treatment, Submerged ceramic membrane bioreactor, Fouling reduction, Sodium alginate, Zerovalent iron nanoparticles.

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Palladium Nanoparticle Impregnated Activated Carbon Materials for Catalytic Oxidation of Carbon Monoxide

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Metal nanoparticles supported catalysts are effective for removing carbon monoxide (CO). Activated Carbon-based materials are used as support material for nanoparticle (NP) impregnation. Activated carbon fiber cloth (ACFC) is the recent member of carbon family. This study investigates the room temperature oxidation of CO over Palladium nanoparticle (Pd NP) impregnated on ACFC. The Pd NP catalyst was prepared using spent Pd/C catalyst as Pd precursor followed by liquid media reduction using different reducing agents. It was observed that the Pd NP impregnated cloth catalyst was effective in removing CO and the high-level moisture has a retardation effect on the catalyst efficiency.
Keywords: Pd nanoparticle; Impregnation; Activated Carbon Fiber Cloth; Pd NP impregnated Activated Carbon Fiber Cloth; Recovered Pd; CO oxidative removal; Moisture.

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Poly Ethylene Glycol Mediated Synthesis of Iron Vanadate (FeVO4) Nanoparticles with Supercapacitive Features

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The binary transition metal oxides possess unleashing potential to be the best electrode material for supercapacitor owing to their high capacitance, stability and conductivity. Thus, the present work investigated the influence of a surfactant, poly ethylene glycol (PEG 4000) on the structure, morphology and electrochemical behaviour of $FeVO_4$ nanoparticles. The synthesised $FeVO_4$ exhibited specific capacitance of 384 Fg^{-1} at a current density of 2 Ag^{-1}, and arguably better rate performance and cyclic stability that $FeVO_4$ synthesised without PEG 4000.Thus, PEG 4000 significantly influenced the morphological and electrochemical performance of the $FeVO_4$.
Keywords: Electrode, Supercapacitor, Surfactant, Sol-Gel synthesis.

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Structural and Electrical Properties of Polyaniline/Vanadium Pentoxide (PANI/V_2O_5) Composites Electromagnetic Applications

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Conducting polyaniline (Pani)/vanadium pentoxide (V_2O_5) composites were prepared by interfacial polymerization method. The spectroscopic characterizations of the composites were performed using X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR). Temperature dependent electrical conductivity showed semiconducting behavior of the composite samples. The electromagnetic properties of the composites were investigated to understand the suitability of the composites for broadband electromagnetic interference (EMI) shielding applications. The EMI shielding measurements were carried out in the frequency range of 12-18 GHz (Ku Band) of practical relevance. The shielding analysis demonstrates the synergistic effect of the complementing phases which leads to high average shielding effectiveness (SE) values in the range of –30 dB (< 99.99 % electromagnetic energy attenuation). The observed higher shielding effectiveness and the possibility to tailor the properties of these composites by varying the concentration of the dispersant vanadium pentoxide suggests the possible optimization of these composites for electromagnetic applications.

Keywords: Polyaniline, vanadium pentoxide, interfacial polymerization, SEM, EMI, SE

ABICNAN2019100532

Surface Roughness and Topographical Characterization of Under Liquid Laser Ablated Magnesium Alloy

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In this experimental investigation, disintegrated melt deposition (DMD) processed Mg_3Al alloy was subjected to under liquid laser ablation in a 1-propanol having graphite particle of size 5 to 9 μm stirred at 1900 rpm by means of a magnetic stirrer. The under liquid laser ablation yielded nano structured surface showing grooves and islands that can promote wettability and the presence of propanol and graphite ensured its impregnation on the surface of the alloy and thus improving its tribological properties. The surface topography, average particles and roughness parameters of the Mg_3Al alloy were studied using atomic force microscope (AFM).

Keywords: Magnesium alloy, disintegrated melt deposition (DMD), laser ablation, surface modification, AFM.

ABICNAN2019100534

Preparation and Characterization of Nanosilica Based Superhydrophobic Dust Repellent Coatings for Solar Panel Top Glass.

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To increase the efficiency of solar panel, superhydrophobic coatings were developed by using silica sol prepared by silica precursor. The analysis showed the coatings are superhydrophobic having nanostructural surface. These coatings showed better efficiency compared to uncoated surface.
***Key words*-** Solar panel, superhydrophobic, sol-gel, IV curve.

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Protonation of Quinoxaline-Tetrathiafulvalene Based Derivatives: Substituent Effect on Charge-Transfer Complexes

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Due to ever-growing demand for green and sustainable energy, these are alternative energy sources to meet the needs of the ever-increasing population in the world. Herein we synthesized four new acceptor–donor–acceptor (A–D–A) based donor tetrathiafulvalene (TTF) fused with different units of acceptors. Absorption studies of the chloroform solutions of the compounds 1-4, have been studied the peaks are exhibiting within the range of 250-550 nm. There is source for the protonation studies in the synthesized molecules, hence we performed protonic absorption studies with hydrochloric acid, and the band shifts from blue region to the red region because of the intra-molecular charge transfer. Protonation on the nitrogen atoms of the TTF based units, allows for the creation of low band gap systems and useful in NIR optical properties, and solar cell applications.
Keywords: Tetrathiafulvalene, substituent role, red region, electrochemical studies.

ABICNAN2019100536

Adsorption Studies of Congo-Red Dye from Aqueous Solution by Pani/$ZnTiO_3$ Nanocomposites

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Polyaniline/$ZnTiO_3$ (PANI/$ZnTiO_3$) nanocomposite is prepared by chemical polymerization method. The prepared samples are characterized by various analytical technique. The PANI/$ZnTiO_3$ is used as an eco-friendly adsorbent to remove Congo-red (CR) dye from aqueous solution. The obtained results show that the CR removal efficiencies depends on the concentration of CR, the mass of adsorbent, pH of the solution, and temperature. The experimental kinetic results are fitted by the pseudo-second-order model. Also, the equilibrium data shows the best fitting with Langmuir isotherm model. The thermodynamic parameters indicate that the adsorption process is endothermic and spontaneous in nature.

Keywords: PANI/$ZnTiO_3$ nanocomposite, Congo red, Adsorption.

ABICNAN2019100538

Experimental Studies of Vapour Compression Refrigeration System with Eco-Friendly Primery Refrigerant and Brine Mixed with Nano Particles as Secondary Refrigerant

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This paper describes thermal modeling of Vapor Compression Refrigeration System using R134a in primary circuit and Al_2O_3-Water based nanofluids in secondary circuit. The model uses information of the secondary fluids input conditions geometric characteristics of the system, size of nano-particles and the compressor speed to predict the secondary fluids output temperatures, the operating pressures, the compressor power consumption and the system overall energy performance. Such an analysis can be conveniently useful to compare the thermal performance of different nano-particles (i.e Al_2O_3, TiO_2) based nano fluid as a secondary fluid in a Vapor Compression Refrigeration System.

Keywords: Alternative refrigerants, Eco Friendly Refrigerants, Nano refrigerant, Energy Exergy Analysis, Irreversibility analysis

ABICNAN2019100539

Fabrication of U-Bent and Straight LSPR Based Fiberoptic Transducers and their Relative Sensing Performance

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A comparative study on the sensing parameters between two geometries of localised surface plasmon resonance (SPR) based fiber optic transducers, viz., the U-bent probes and the straight probes with respect to changes in refractive indices is reported for the first time. Gold nanoparticles were coated onto the thiol-modified plastic optical fiber and the sensing studies were conducted with different concentrations of sucrose and ethanol with refractive index values ranging from 1.3332 to 1.3548. The above studies showed that the straight fiber probe configuration was superior in terms of sensing performance due to better re-coupling of SPR signals with the optical fiber.

Keywords: Localised surface plasmon resonance (LSPR), Gold nanoparticles, Fiber Optic Sensors, Polymethyl methacrylate (PMMA), Plastic optical fiber (POF).

ABICNAN2019100540

Novel D-π-A Carbazole Dye on Ag-TiO_2 Anode and Graphene Quantum Dot Cathode for DSSC

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D-***π***-A type carbazole sensitizer was synthesized with carboxylic acid as the acceptor, aryl unit as ***π***-bridge and electron rich carbazole unit acting as the electron donor. The synthesized compound was confirmed by $_1$H NMR and mass spectroscopy. Silver doped titanium dioxide (Ag-TiO_2) nano particles were synthesized by using sol-gel method and used for photo anode. TiO_2 nanoparticles were decorated with different concentrations of Ag to improve their photovoltaic properties. XRD and FESEM were used to characterize prepared doped and undoped TiO_2. Tetrabutylammonium iodide doped Polyvinyl alcohol (PVA) – Polyvinylpyrrolidone (PVP) based blend polymer electrolytes were prepared and studied their conductivity. The graphene quantum dot was prepared by using hydrothermal method for efficient counter electrode.

Keywords: Carbazole dye, Ag-TiO_2, PVA-PVP blend polymer electrolyte, Graphene quantum dot.

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Fabrication and Characterization of Ni-Co Nano-architecture for Device and Designing

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Fabrication of $NiCo_2O_4$ nanostructure for application point of view shows the favourable aspects like higher aspect ratio, higher porosity and repeatability of redox reaction. High porous structure directly relates the reactive site which plays the electron transport property that displays the energy storage as well as sensing property. Scanning Electron microscope (SEM) and Cyclic Voltametry (CV) characterisations are enough to tell about the electrode behaviour towards glucose sensing and supercapacitor application, which has been presented here.

Keywords: Cyclic Voltammetry (CV), SEM.

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Surface Engineered Fluorescent Graphene Quantum Dots for Cellular Imaging

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Graphene quantum dots (GQDs), the nanosized semiconductors, have unique properties such as fluorescence, better photostability and biocompatibility which enable them for advanced biofunctional applications, in particular, bioimaging. In the present study, GQDs with high fluorescence were synthesized by adopting novel pyrolytic conditions followed by surface engineering to modulate its functional properties and investigated for cellular imaging applications.

Keywords: Graphene Quantum Dot, Fluorescence, Citric acid.

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Layered Double Hydroxide with Tunable Interlayer Space for Theranostic Applications

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Recent advancement in nanomaterials has contributed much towards the development of potential nanodevices for cancer theranostics. Layered double hydroxides (LDH) present unique class of drug carriers due to their inherent potential to intercalate negatively charged guest molecules, therapeutic drug molecules, into the positively charged layers. Here we present the synthesis and characterization of LDH which is further intercalated with chemotherapeutic drug doxorubicin hydrochloride (DOX) and demonstrated the dependence of pH in releasing the drug from the host layers.

Keywords: Layered double hydroxide, drug delivery, doxorubicin, intercalation

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Laser-Induced Graphene Using Custom Made Continuous Wave Laser

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Graphene is one atom thick material, which exhibits a highly remarkable crystal structure and an electronic quality with an unusual electronic spectrum [1]. Top down approach is one of the suitable methods which provide an opportunity for large scale production of graphene. We have synthesized Graphene by an easy and environment-friendly Laser method. In this preparation procedure, porous graphene films have been produced from polymer sheets by laser induction. Usually researchers use high power CO_2 laser for this purpose which is very expensive. Hence in this work a 2W continuous wave laser set up has been used to irradiate the commercial Polyimide (PI) film.

Keywords: Laser-Induced Graphene, Kapton sheet, Continuous wave laser.

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Microstructural, Optical and Electrical Properties of Cu, In & Ag Doped SnS Nanostructures for the Application of Thin Film Solar Cells

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Concerning the efficiency limitation factors of SnS based thin film solar cells, this work reports the optimization study of single phase orthorhombic structured SnS nanostructures without any secondary phases such as SnS, SnS_2 and Sn_2S_3 using simple wet chemical route and sputtering technique by tailoring various experimental conditions. By following the optimized experimental conditions, Cu, In and Ag doped SnS nanostructures were prepared with increasing the doping up to ~ 10%. The substitutional doping of dopant cation into SnS lattice sites, enabled to tune the electrical and optical properties of SnS.

Keywords: Thin film solar cells, Tin sulphide, substitutional doping, structural properties, optical and electrical properties

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A Comparative Study on Organic Polymer Materials for Energy Harvesting Applications: A Review

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In recent years, due to technological advancements more number of modern portable tiny electronics are coming into existence in our day-to-day life and their energy requirements also very less in terms of few mW/μW. This act as a key point for many researchers to turn their heads towards energy harvesting techniques by interconnecting many branches of Science like basic Physics, Chemistry and Engineering Technology like Nanotechnology, Material Science, Electrical and Electronics, Wireless Communication Network and even Biomedical Science. The impact of energy harvesting techniques also plays a significant role in real time applications in various sectors like healthcare, Environmental gas sensing applications, Defence and Airforce Applications, Wearable electronics, infrastructure building Monitoring and security systems. Among various comparative investigations of different materials, organic polymer materials holds quite good due to its attractive features like biocompatibility, environmental friendly, flexibility, sustainability, pollution free and also electromechanical coupling in nature. This article discuss about the comparative analysis of various organic polymer materials like PTFE (Polytetra Fluoroethylene), Polymide, PVDF(Polyvinylidene fluoride), PDMS (Poly Dimethylsiloxane) which is suitable for self-generating applications based on their structural, thermal, mechanical & electrical properties. Moreover these active nanogenerators can able to harvest energy from variable environmental sources like solar, wind, temperature gradient and even from ocean currents so called as blue energy.

Keywords: energy harvestors, organic materials, portable tiny electronics, polymer materials, mW/μW, PDMS, PTFE, PI, PVDF

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Electrospun $LiMn_2O_4$ Nanofibers for High Performance Li-Ion Batteries

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Spinel lithium manganese oxide ($LiMn_2O_4$) nanofibers as a positive electrode material for the Li-ion battery were fabricated by electrospinning technique. Prepared samples were characterized by using TG-DTA, XRD, FTIR, Raman, SEM-EDX, HR-TEM, AFM respectively, were conducted to find out the thermal, structural, and morphological studies. The impedance measurements were carried out at different temperatures and frequencies, were analysed to obtain the electrical conductivity of spinel $LiMn_2O_4$ nanofibers at 423 K is found to be 4.29 x 10-3 S cm^{-1}. The CR-2032 type coin cells were fabricated by using the prepared $LiMn_2O_4$ nanofibers electrochemical performance were investigated. The charge-discharge cycles in the voltage range 3.1-4.4 V coin-type cell showed that $LiMn_2O_4$ nanofibers exhibit the excellent electrochemical performance.

Keywords: $LiMn_2O_4$ nanofibers; Electrospinning; Electrical & dielectric properties; Electrochemical performance.

ABICNAN2019100558

Stabilisation of Various Types of Nitrogen on Nitrogen Doped Graphene Oxide Supported on Nitrogen Doped TiO_2 under Ultrasonication – A Mechanistic Over View

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Production of hydrogen by photocatalytic water splitting is an attractive technology for producing clean energy without pollution or by products. For efficient photocatalytic H_2 production, we report the simultaneous doping of nitrogen on titanium dioxide (N-TiO_2) and reduced graphene oxide (N-RGO) by ultrasonication followed by hydrothermal method. The present work supports the stabilization of a given type of nitrogen on N-RGO through keto – enol tautomerism and a mechanism has been proposed for the stabilisation for each type of nitrogen on N-RGO as a function of ultrasonication time. XPS studies have been carried out to identify the type of nitrogen.

Keywords: Ultrasonication, Pyrrolic nitrogen, Nitrogen doped Reduced graphene oxide, Hydrogen production, One pot hydrothermal reduction.

ABICNAN2019100563

High Mobility CdTe Nanoparticles Synthesized By Single Injection Hydrothermal Method for Device Applications

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High mobility CdTe nanoparticles are synthesized for different duration of synthesis. CdTe nanoparticles are found to crystallize in to hexagonal crystal structure. As the time of synthesis increases the particle size is found to increase. Van Der Pauw method of Hall measurement is employed to study the Hall parameters, which has shown that the synthesized CdTe nanoparticles are of n-type conductivity.

Keywords: single injection hydrothermal method, High mobility, n-type CdTe, Hall parameters, conductivity

ABICNAN2019100566

Co_3O_4 Doped PVA/PPy Nano Composites and Their Functional, Structural, Morphological and Tensile Properties

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Cobalt oxide (Co_3O_4) doped in Polyvinyl alcohol (PVA) and Polypyrrol (PPy) blend polymer nano composites (PNCs) are prepared by solution casting technique for different volume

percentages. The PVA/PPy/Co_3O_4 nanocomposites are characterized with Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), Atomic Force Microscopy (AFM) and Tensile Properties. The FTIR results indicate strong chemical interaction between blend and Co_3O_4 polymer systems. XRD studies disclosed the morphology of the nanocomposites. The tensile properties such as Young's modulus, proportionality limit, yield strength etc have also been calculated.

***Keywords**:* Polymer nanocomposites, solution casting, Optical properties, Mechanical Studies.

ABICNAN2019100567

Near-Field Enhancement of CdTe/Cds Quantum Dots Fluorescence by Plasmonic Poloxamer Stabilized Silver Nanoparticles

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Optimal Plasmon-Quantum dot interaction has been shown to induce near field enhancement (NFE) effect characterized by enhanced fluorescence intensity are applicable in development of fluorescent nanosensors. Here we report, Poloxamer 188 stabilized Silver nanoparticles in aqueous solution induce resonance energy transfer (RET) leading to two-fold enhancement in CdTe/CdS QDs fluorescence intensity. Nevertheless, increasing AgNP or QD concentration and Silica-coating has inverse effect on RET process suggesting the possible of non-radiative fluorescence decay. Further, high concentration of AgNP and silica coating may prevent plasmonic interaction with excitons due to altered dipole interaction induced by AgNP aggregation or additional silica layer.

Keywords: AgNP, Quantum dot, NFE, Poloxamer, Silica.

ABICNAN2019100568

Functionalization of Multiwalled Carbon Nanotubes (MWCNTs) With Active Pharmaceutical Ingredient via Carboxylation

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We experimented the functionalization of multiwalled carbon nanotubes by simple and laboratory friendly reaction path. The exercise was done by hypothesizing the enhancement in the activation of CNT walls which subsequently were used for the functionalization of active pharmaceutical ingredient (API). The tailoring of MWCNTs was achieved by suspending the MWCNTs in acidic mixture having nitric acid and sulphuric acid (HNO_3/H_2SO_4) in volume proportionate. The reaction mixture was stirred manually followed by ultra-sonication and magnetic stirring for specific time interval to achieve the desired end product. After achieving promising analytical data, the functionalised MWCNTs (f- MWCNTs) were doped with API in alkaline medium. The obtained solids were further characterised by key analytical techniques like FTIR and Powder XRD (p-XRD).

Keywords: Functionalization, Active pharmaceutical ingredient, Ultra sonication, Acid mixture, FTIR

ABICNAN2019100569

Cellulose Based Hydrogel as a Substrate for Tissue Engineering Applications

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Hydrogels are three-dimensional network structure of hydrophilic polymers, which have the capacity of absorbing a large amount of water. In this study, we developed carboxylic acid cross-linked carboxymethyl cellulose (CMC) hydrogels scaffold for tissue regeneration. The crosslinking of hydrogels was analyzed by attenuated total reflectance Fourier transform infrared spectroscopy. The swelling ability of cross-linked hydrogels was measured in different solutions of water, phosphate-buffered saline (PBS) and cell culture media. FTIR spectra confirmed the cross-linking of carboxymethyl cellulose *via* esterification reaction. The cross-linked hydrogels showed excellent swelling capacity and are stable in water, PBS and media for 24 hours. These results showed that the carboxylic acid cross-linked CMC hydrogels with improved stability can be used for tissue engineering applications.
Keywords: Hydrogels, carboxymethyl cellulose, crosslinking, swelling, tissue engineering.

ABICNAN2019100571

NiFe Layered double hydroxide-Decorated N-Doped Entangled-Graphene Framework: A Robust Water Oxidation Electrocatalyst.

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Three Dimensional (3D) porous carbon materials are highly desirable for electrochemical applications owing to their high surface area and porosity. Uniformly distributed porosity in the 3D architecture of the carbon support materials allows the reactant molecules to access more numbers of electrochemical active centres and simultaneously facilitate easy removal of the product formed during the electrochemical reactions. Herein, we have prepared nitrogen-doped entangled graphene framework (NEGF), decorated with the NiFe-LDH nanostructures by *in-situ* solvothermal method followed by freeze-drying at high vacuum pressure and low-temperature conditions. The freeze-drying method helped to prevent the restacking of graphene sheets, and the formation of high surface area nitrogen-doped entangled graphene (NEGF) supported NiFe-LDH. The incorporation of NEGF has significantly reduced the overpotential for the electrochemical oxygen evolution reaction (OER) in 1 M KOH solution. This corresponds to an overpotential reduction from 340 mV for NiFe-LDH to 290 mV for NiFe-LDH/NEGF to reach the benchmark current density of 10 mA cm−2. The preparation of the catalyst is conceived through a low-temperature scalable process.

ABICNAN2019100572

Synthesis and Characterization of Biomimetic Hydroxyapatite Plates in the Presence of L-Histidine

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Millions of people suffer from bone injuries worldwide, leading to the chronic pain, longterm disability or death. Hydroxyapatite (HA), a main component of bones, has been used as a bone filler[1] but the bioactivity of synthetic HA has been found to be lower than bone apatite. Therefore, several organic molecules have been used to synthesize bone-like apatite. Although non-stoichiometric HA have been synthesized in the presence of various amino acids, the development of plate-shaped bone-like HA under physiological conditions remains a challenge. In this work, we report that the presence of L-histidine results in nonstoichiometric biomimetic HA plates under physiological conditions.
Keywords: Biomimetic, hydroxyapatite, amino acid, L-histidine

ABICNAN2019100573

Investigation on the Photocatalytic Property of Size Dependent $BiMnO_3$ Nanoparticles for the Degradation of Organic Pollutants

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The photocatalytic activity have been enhanced by the size reduced nanoparticles as a photocatalyst, which have been helpful for solving the environmental problems. The $BiMnO_3$ (BMO) photocatalyst was synthesized via hydrothermal method and studied its size effect using with and without surfactant CTAB. The properties were studied using XRD, SEM, FT-IR, UV BMO nanoparticles showed the visible range absorbance and the energy bandgap values were in the range of 1 to 1.3 eV which is very suitable for degradation of organic pollutants.
Keywords: $BiMnO_3$, Nanoparticles, UV, Photocatalytic activity.

ABICNAN2019100574

Fabrication of Biocomposite Sheets from Silk Cocoons for Tissue Engineering Applications

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Silk based biomaterials are attractive in tissue engineering because of their excellent mechanical integrity, biodegradability and biocompatibility. In this study, bone-like apatite coating on the surface of silk cocoons was carried out through biomineralization process. Physicochemical, morphology and mechanical properties of the prepared biocomposite sheets were investigated. Apatite formation on the silk cocoons was confirmed with XRD and FTIR analysis. Biocomposite sheets showed good thermal stability, porous fibrous structure with homogeneous apatite deposition and considerable tensile strength. Therefore, this study could provide significant implications on biomineralization of silk cocoons as a potential scaffold for tissue engineering applications.
Keywords: Silk cocoons, mineralization, apatite, biocomposite sheets, tissue engineering

ABICNAN2019100576

Alkali Activated Porous Material with Nano Graphene Oxide as Adsorbents in Wastewater Treatment

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Removal of contaminants, impurities and suspended solid matter are termed as water treatment. The possible water treatment methods are coagulation, filtration, ion exchange, aerobic and non aerobic methods. But all this involves high cost. Earlier filtration using granular sand was termed as the efficient way of water treatment. But due to the non-availability of sand this method is no more adopted. The most effective and easy means of treatment of water and waste water is adsorption method because it is an easy and convenient method. Though there are many adsorbents like activated carbon, clay minerals, zeolite, plant based and industrial based by products, the commonly used material is activated carbon which is again a costly investment. The next effective material is the zeolite. It has proved to perform well than the granular media and conventional activated carbon in removing heavy metals and ammonia. The advantage of using zeolite is that it adsorbs these contaminants in its pores and forms a strong bond which prevents leaching of these contaminants back to the ground water. This research work will be focused on synthesizing alkali activated aerated concrete with graphene oxide which is porous and which can act as an efficient adsorbent in removing the contaminants from water and waste water respectively.
Keywords: adsorbent, heavy metals, porous, alkali activation, efficiency

ABICNAN2019100577

Modelling and Simulation of Piezoelectric Materials for Nano Scale Applications

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The achievement in the nanotechnology enhanced the technological progress towards miniaturization of the devices. The transition from millimetre to micro / nano meter in the fabrication techniques led to the nano structures. Modelling of any device enables to predict its

behaviour based on the fundamental theory that drives it. We present modal analysis of piezoelectric structures which enables to determine the natural frequencies and mode shapes of the structure by the tool ANSYS 15.0. The piezoelectric materials considered for analysis is $BaTiO_3$, a lead- free piezoelectric ceramic material.

Keywords: Material modelling, Piezoelectric, Finite Element Method, Nano electronics.

ABICNAN2019100579

Investigation of the Electrical and Mechanical Properties of PVA-Graphite Nanoplatelets Composite Films

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Polyvinyl alcohol (PVA) composites with graphite nanoplatelets (GnP) were prepared via solution casting method. In this work, we propose the preparation of PVA based graphite nanoplatelet composites. This will improve the electrical conductivity of PVA nanocomposite. To study the effect of GnP addition on electrical properties, a systematic study was performed by varying the concentration of GnP in the composite. The electrical percolation threshold was found using dielectric studies. The improvement in the properties of PVA/GnP composites will be analysed using mechanical and thermal studies on the prepared nanocomposites.

Keywords: Dielectrics, Polymers, Nanocomposite materials, Percolation threshold

ABICNAN2019100581

Ultra Long Life Supercapacitor Fabricated Using Vertically Aligned Graphene on Carbon Fibres

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In this work we report a facile, simple method to fabricate highly flexible and a very high cycle life supercapacitor with vertically stacked graphene on carbon fibres as electrodes. This vertical alignment of graphene on carbon fibres was achieved via electrophoretic deposition (EPD), giving it a unique mesoporous three dimensional architecture. This type of architecture not only enabled fast and efficient electrolyte ion diffusion but also enhanced the electrode surface area significantly. A single electrode delivered a gravimetric capacitance of 333.3 Fg^{-1} and an areal capacitance of 166 mF cm^{-2} with an exceptionally long cycle life of over 100000 cycles with almost 100% capacitance retention promising a long lasting supercapacitor life.

Keywords: Vertically-alligned, Graphene-Carbon fiber, Hybrid, Super-long cyclic stability.

ABICNAN2019100582

Role of Protic Ionic Liquid Concentration in Proton Conducting Polymer Electrolytes for Improved Electrical and Thermal Properties

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In the present work we report the preparation of a non-aqueous proton conducting polymer electrolytes based on PVDF-HFP polymer, H_3PO_4 and the protic ionic liquid diethylmethyl ammonium trifluoromethanesulfonate ([dema][TfO]). The effect of ionic liquid concentration on thermal and electrical properties of polymer electrolytes were studied by varying the concentration of [dema][TfO] in the system. It is observed from the room temperature electrical studies that the ionic conductivity of the prepared samples were improved by two orders on addition of ionic liquid in to the system. A highest ionic conductivity of ~ 4.4×10^{-4} S cm^{-1} was observed at 20-40 wt. % of [dema][TfO].
Keywords: [dema][TfO], proton conducting polymer electrolytes, H3PO4

ABICNAN2019100585

The Properties of Scaffolds Based on Chitosan and Collagen with Bioglass 45S5

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Natural polymers are widely used in biomaterials, however, they have to be modified by different cross-linking methods. Tannic acid is natural compounds which can form hydrogen interactions with functional groups of chitosan and collagen. Moreover, to improve biological response inorganic compounds can be added. The results showed that cross-linker addition changes the pores size. Bioglass 45S5 presence did not showed any significant influence on the biological properties of scaffolds.
Keywords: chitosan, collagen, bioglass 45S5, scaffolds, nanotechnology

ABICNAN2019100586

Luminescence Characterization of (Eu–Y) Nano Phosphors

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The word luminescence stands generating of cold light. Europium and Yttrium are the elements which are strong capable for the luminescence with phosphate compounds. We approach with Europium and Yttrium oxides with Phosphate and observed the PL emission peak at 611 nm under excitation observed , generally luminescence emission occur in various colors. Europium ion usually used as a sensitizer because of strong absorption
Keywords: Photo luminescence, low phonon energy, Pechini foaming method, mild heating, phosphoric meter, electric dipole transition

ABICNAN2019100588

Influence of Organic Acids on the Surface and Corrosion Resistant Behavior of Anodized Films on AA2024 Aerospace Alloys in Artificial Seawater

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This study aims to evaluate the influence of dicarboxylic acids (oxalic, malonic and succinic acid) used in anodization bath on the surface and corrosion resistant performance of anodized films on AA2024 aerospace grade alloys. The surface morphology, topography, composition and structure of anodized samples were examined by scanning electron microscopy, optical profilometer, X-ray diffraction and attenuated total reflectance-infrared techniques. Characterization results revealed the effect of dicarboxylic acids addition on the anodized film's surface with important changes. X-ray Photoelectron Spectroscopic analysis confirmed the presence of carboxylic groups on the porous anodized layer processed in anodization bath containing succinic acid. The electrochemical corrosion tests specified a solid relationship between the corrosion resistance and the surface microstructure of the anodized layer processed in different dicarboxylic acids.

Keywords: Al alloys, Corrosion, Anodization, Organic acids.

ABICNAN2019100589

Piezoelectric-Driven Charging Supercapacitors for Bio-Medical Sensor Applications (Continuous Glucose Monitor)

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Piezoelectric materials can be fabricated as a generator to transform mechanical energy in ambient vibration into electrical energy, which can be stored and used to power some ultra-low power devices such as radio frequency identification (RFID) tags. Since most of the ultra-low power devices are wireless, it becomes essential to have their own independent power supplies. In tradition, the power supplies come from bulky batteries, which have environment unfriendly chemical ingredients. Most importantly, the batteries have limited life of 500-1000 cycles compared to millions or more for most commercially available Supercapacitor. With the introduction of many handheld portable electronic gadgets, energy harvesting has become one of the fascinating subjects of interest to provide portable electrical power.

Keywords: Piezoelectric, Supercapacitor, Ultra-low power devices, Wireless

ABICNAN2019100593

High Performance Supercapacitor Studies for Luminescent Nitrogen Doped Graphene Quantum Dots

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We present a novel process of Graphene Quantum Dots (GQDs) doped with different nano-composites of silver and gold nanoparticles by selecting amino acids and graphene oxide (GO) as source materials via a facile hydrothermal method. The electrochemical performance of the GQDs was demonstrated through galvanostatic charge−discharge (GCD) method for three electrode cells with two different electrolytes of 1.0 M KOH as well as 1M $K4FeCN_6$. The measured high specific capacitance for doped GQDs with nitrogen electrode was found to be 225 Fg^{-1} at 0.1mAg^{-1} due to enhancement in electrical conductivity and improvement in the electron transfer between electrodes and electrolyte.
***Keywords**:* Graphene Quantum Dots, Amino Acids, Silver nanoparticles, Gold Nanoparticles, Hydrothermal Method, Supercapacitor Electrode.

ABICNAN2019100596

Structural and Magnetic Properties of $Ba_{0.5}Sr_{0.5}Fe_{12}O_{19}/Y_3Fe_5O_{12}$ Nanocomposites

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In this work, we study the magnetic properties of $Ba_{0.5}Sr_{0.5}Fe_{12}O_{19}(1-x)/Y_3Fe_5O_{12}(x)$ (BSFO/YIG) synthesized by co-precipitation method in different ratios (x-0.1, 0,2, 0.3, and 0.4). The synthesized samples were subjected to structural using X-ray diffraction. The enhancement of magnetic properties like saturation magnetization, and coercivity were measured by Vibrational Sample Magnetometer. The results of BSFO/YIG composite sample with different composition (x=0.1, 0.2, 0.3, 0.4 and 0.5) will be discussed in detail.
Keywords: Hard/soft nanocomposite, Magnetic properties, $Ba_{0.5}Sr_{0.5}Fe_{12}O_{19}$, $Y_3Fe_5O_{12}$.

ABICNAN2019100597

Electromagnetic Interference Shielding Effectiveness of the Hard/Soft Ferrite Nanocomposite-$Ba_{0.5}Sr_{0.5}Fe_{12}O_{19}$ (1-x)/$NiFe_2O_4$ (x)

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Magnetic nano-composite constituted by barium strontium hexaferrite and nickel ferrite as the hard and the soft phase respectively-$Ba_{0.5}Sr_{0.5}Fe_{12}O_{19\ (1-x)}/NiFe_2O_4$ (x) with the compositions x= 0.1, 0.2, 0.3, 0.4, were synthesized by a 'One-Pot synthesis' technique using citric acid as the fuel. The homogeneous solution obtained was heat treated until a greenish gel formed, which was dried and at 1100° C for 2 hours. The structural, thermal, morphological and magnetic studies were done on the synthesized samples. The EMI shielding studies were done by Vector Network Analysis (VNA). A minimum reflection loss of -38.47 dB was attained by the composition x= 0.4.

Keywords: Magnetic composite, hard-soft ferrite, One-pot synthesis, magnetic properties, EMI shielding.

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Filtration Characteristics of Nanoparticles Additives

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Nanoparticles additives play a significant role in enhancing the engine efficiency through better ignition, combustion, lower ignition delay and low emission to ensure cleaner environment. A study was conducted on evaluating the filtration performance of diesel in the presence of nanoparticles of chosen additives viz., Graphene nanoparticles, Graphene oxide. To arrive at the optimum mix of the nanoparticles of these additives, various proportions starting from 20 ppm of nanoparticles of additives were blended in diesel and the filtration characteristics were investigated. The filtration performance was monitored under the conditions of temperature, pre-test pressure, flow rate as per ASTM standard (D2068-14). It was observed that the Filter Blocking Tendency (FBT) as measured by Tamson Filter Blocking Tendency (TFBT) apparatus tended to increase with increase in additive proportion. A maximum of 80 ppm of nanoparticles such as graphene nanoparticles, graphene oxide was found to keep the Filter Blocking Tendency (FBT) within the acceptable limit of 1.41 (1). Use of 20ppm of graphene nanoparticles in pure diesel resulted FBT value of 1.01 indicating good filterability characteristics. This finding has far reaching consequence of attempting at different concentrations of nanoparticles additives with diesel to ensure safer and cleaner environment besides ensuring enhanced performance.

Keywords: TFBT, FBT, Graphene

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Filtration Characteristics of Nanoparticles Additives

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Nanoparticles additives play a significant role in enhancing the engine efficiency through better ignition, combustion, lower ignition delay and low emission to ensure cleaner environment. A study was conducted on evaluating the filtration performance of diesel in the presence of nanoparticles of chosen additives viz., Graphene nanoparticles, Graphene oxide. To arrive at the optimum mix of the nanoparticles of these additives, various proportions starting from 20 ppm of nanoparticles of additives were blended in diesel and the filtration characteristics were investigated. The filtration performance was monitored under the conditions of temperature, pre-test pressure, flow rate as per ASTM standard (D2068-14). It was observed that the Filter Blocking Tendency (FBT) as measured by Tamson Filter Blocking Tendency (TFBT) apparatus tended to increase with increase in additive proportion. Required proportion of graphene nanoparticles and graphene oxide is blended with diesel with the help of magnetic stirrer and ultrasonicator. Magnetic stirree is used at 600 rpm for 15 min of time for proper mixing of nanoparticle additives with diesel. Later, ultrasonicator is used at 20Hz for 20 min

for even better mixing of additives with the fuel. A maximum of 100 ppm of nanoparticles such as graphene nanoparticles, graphene oxide was found to keep the Filter Blocking Tendency (FBT) within the acceptable limit of 1.41 (1). Use of 20ppm of graphene nanoparticles in pure diesel resulted FBT value of 1.01 indicating good filterability characteristics. Usage of graphene nano-particles with diesel in the range of 100 ppm to 250 ppm gives good filtration nature. Graphene oxide when blended with diesel in the concentrations in the range of 100 ppm to 250 ppm gives good filterability. Adding additives like graphene oxide, graphene nanoparticle also lowers the FBT values. Lower the FBT value, better the engine efficiency. This finding has far reaching consequence of attempting at different concentrations of nanoparticles additives with diesel to ensure safer and cleaner environment besides ensuring enhanced performance.

Keywords: Nanoparticle additives, filter blocking tendency.

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Cobalt Nickel Ferrite As Exhaust Thrust Sensor

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Exhaust thrust sensors have an increasing demand in exhaust air circulator of automobile engine. In the present article $CoNiFe_2O_4$ is synthesized by ceramic route and are sintered using microwaves. The structural and morphology are studied using X-ray diffraction and scanning electron microscopy. The magnetic permeability, stress and exhaust pressure sensitivity are studied for possible exhaust thrust sensor applications.

***Keywords*:** Exhaust thrust sensor, stress sensitivity, permeability, SEM, XRD.

ABICNAN2019100605

Preparation and Characterization of Magnetosomes Based Anticancer Drug Conjugates for Cancer Therapy

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We report a novel, effective and enhanced method of conjugating anticancer drug (Paclitaxel, Gallic acid) with magnetosomes. We functionalized magnetosomes with the anticancer drugs individually by direct and indirect (via crosslinkers: Glutaraldehyde, APTES) adsorption methods. The prepared magnetosome-drug conjugates (Mag-pac and Mag-Gal) were characterized by FTIR, Zeta potential, TGA/DSC, drug loading efficiency/capacity, drug release. The apoptosis effect of the magnetosomes-drug conjugates were performed against HeLa cell lines by MTT followed by ROS, AO/EB, DAPI. Protein expression levels of P53 were determined by SDS and western blotting. The magnetosome-drug conjugates prepared by direct adsorption achieved the best effects on the drug loading efficiency, cellular uptake, and the increased percentage of cancer cell mortality, the upregulation of P53.

Keywords: Magnetosomes, functionalization, crosslinkers, drug conjugate, cytotoxicity.

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Development of Magnetosome Based Biosensor for the Detection of *Listeria Monocytogenes* in Food Sample

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Listeriosis through contaminated food is one of the leading causes of premature deaths in pregnant women's and new born babies worldwide. Biosensor technology merged with nanoparticles has great potential in detecting such food borne pathogens. In this study, we have developed a magnetosome based biosensor for the rapid, sensitive, specific and cost effective detection of *Listeria monocytogenes* from food sample. Magnetosome (1 and 2 mg/ml) were directly bound to Anti-Listeriolysin (LLO) antibody (0.25–2.5 μg/ml) and confirmed through spectroscopic analysis. Active listeriolysin (LLO) protein (0.01–7 μg/ml) was added to the magnetosome-LLO antibody complex and optimized through ELISA. Magnetosome (2mg/ml) conjugated with LLO antibody (0.25 μg/ml) was optimum concentration to detect LLO protein (0.01 μg/ml). Magnetosome conjugated LLO antibody used in ELISA was 25% cost effective. The magnetosome-LLO antibody complex was directly stabilized on screen printed electrode through an external magnet to carry out electrochemical studies. The significant increase in resistance (RCT value) on the electrode surface with increase in concentration of LLO protein was confirmed in impedance spectroscopy. The *Listeria monocytogenes* contaminated milk and water sample (confirmed in ELISA) were processed and extracted LLO protein was then detected in the developed biosensor. The specificity of the biosensor was confirmed in cross reactivity assay with other food pathogens. Further, the biosensor directly detected 101 cfu/ml active cells of *Listeria monocytogenes* in milk and water sample which highlights its sensitive nature.

Keywords: *Listeria monocytogenes*, Listeriolysin, LLO antibody, Magnetosome, impedance, food sample

ABICNAN2019100609

Enhancement of Cooling Rate Using Nanofluid and Hybrid Nanofluids in Cooling Hot Titanium Plate

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Hot titanium grade-9 plate is used in investigating efficiency of quenching in three different fluids, namely the distilled water, Al_2O_3/water nanofluid and Al_2O_3-TiO_2/water hybrid nanofluid [HyNF] to remove high heat flux, and their performance was compared. A K-type thermocouple was embedded on the bottom surface of the plate to measure the temperature. The time-temperature data were recorded by the help of a data acquisition system. Experimental results revealed that the nanofluid as well as hybrid nanofluid enhanced the

maximum value of cooling rate as expected. Also hybrid nanofluid exhibit higher efficiency compared to Al_2O_3/water nanofluid.

Keywords: Nanofluid, Hybrid nanofluid, cooling rate.

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Self-Powered Patient Monitoring System Using Triboelectric Nanogenerator

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As per the medical survey thousands of people are suffering from paralysis. The presently available monitoring systems for patients affected by paralysis are expensive and difficult to operate which raises an urgent need for cost-effective, battery-free, sustainable solutions that can integrate self-assessment along with a continuous projection of the patient's progress. We aim to achieve a real-time patient health monitoring system using the capabilities of the Triboelectric Nanogenerator (TENG). The proposed system converts mechanical triggering into a self-generated electrical signal for detection of body motion and physical movement by patients affected with leg paralysis.

Keywords: Triboelectric Nanogenerator, paralysis, real-time, cost-effective, eco-friendly.

ABICNAN2019100615

Biomaterial Functionalized Graphene-Magnetite Nanobiocomposite: A Novel Approach for Simultaneous Removal of Anionic Dyes and Heavy-Metal Ions from Multicomponent System

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Despite of immense application potential of graphene in wastewater treatment, the colloidal stability, aggregation and recyclability remains a major challenge. To address this issue, we report biomaterial functionalized graphene-magnetite (*Bio*-GM) nanobiocomposite as a novel recyclable material for treatment of wastewater containing dyes and heavy metal. The integration of biomaterial including living cells of *Shewanella oneidensis* with graphene-magnetite nanocomposite has been characterized through UV-vis, FTIR, FESEM and fluorescent microscopic studies. The contact angle measurement depicts the hydrophilic property (water contact-angle 27.93°), while VSM result demonstrates super paramagnetic behavior of the nanobiocomposite with saturation magnetization value of 30.2 emu/g. The *Bio*-GM nanobiocomposite exhibits excellent adsorption capacity towards dyes and Cr^{6+} in both single and multicomponent system with removal capacity of 189.63 ± 7.11, and 222.2 ± 8.64 mg/g of dyes and Cr^{+6}, respectively in multicomponent dye-heavy metal system, suggesting selective binding capacity and high adsorption efficiency of *Bio*-GM nanobiocomposite. In the adsorption coupled redox reaction, the Cr^{+6} is reduced to Cr^{+3} through biocatalytic activity of *Bio*-GM nanobiocomposite. The nanobiocomposite is easily regenerated and reused for multiple cycles of adsorption-desorption studies without release of graphene and magnetite, and thus eliminating the potential hazardous risk of nanomaterial to the environment. The

proposed biomaterial functionalized graphene-magnetite nanobiocomposite thus offers a novel way for sustainable, affordable and efficient removal of coexistenting toxic pollutants of dyes and heavy metal.

Keywords: Graphene, Magnetite, Nanobiocomposite, Adsorption, Biocatalytic activity

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Mo-Doped Strontium Cobaltite Perovskite as an Advanced Electrode Material for Hybrid Supercapacitor Cell

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In the present work, we report oxygen vacancy enriched Mo-doped strontium cobaltite ($SrCo_{0.9}Mo_{0.1}O_{3-\delta}$, SCM) as a high charge storage material using sol-gel method. Doping of Mo in $SrCoO_{3-\delta}$ (SC) improves the structural stability, oxygen vacancies and therefore enhance the charge storage and cycling life of SCM. Electrochemical investigations of SCM electrode reveal high specific capacitance of 1223.34 F g^{-1} at 1 A g^{-1} in the potential window of 0.5 V. Hybrid cell SCM‖LRGONR is assembled using lacey reduced graphene oxide nanoribbon (LRGONR) as anode which exhibits high energy density (74.8 Wh kg^{-1} @734.5 W kg^{-1}).

Keywords: supercapacitor, perovskite, hybrid cell, strontium cobaltite, oxygen vacancy.

ABICNAN2019100618

Wearable Microstrip Patch Antennas with Different Flexible Substrates for Health Monitoring System

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In this paper, U-shaped slot Rectangular Microstrip Patch Antenna (RMSA) is designed and simulated using high frequency structure simulator (HFSS) and analyzed their performance by using different flexible substrates. Polydimethylsiloxane (PDMS) is used as substrate material in which the flexibility and dielectric permittivity can be adjusted by adding nanofillers. The RMSA is designed to operate for a resonant frequency of 2.4-2.6 GHz with flexible substrate materials such as Polydimethylsiloxane (PDMS), Epoxy, Polyethylene, polyamide, RT Duroid and Teflon. The antenna parameters like reflection coefficient, radiation pattern, gain, bandwidth and cost are analyzed by keeping all the substrates height same. The proposed antenna is suitable for health monitoring system, weight monitoring system and self monitoring system.

Keywords: Polydimethylsiloxane, RMSA, flexible substrates, HFSS, health monitoring system.

ABICNAN2019100621

Hierarchical Magnesium Oxide Anchored Cerium Oxide Nanocomposites for Improvement in Magnetic Properties and Photocatalytic Performance

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A facile strategy was introduced for development of pure MgO and its nanocomposites using different CeO_2 content (3% to 7%) to enhance photocatalytic activity and magnetic performance. The nanoflowers and rhombohedral nanostructures were obtained from in-situ hydrothermal method at different concentration of CeO_2. X-ray diffraction results revealed that peaks of CeO_2 were observed along with peaks of MgO which confirms the presence of both phases. Crystallite size and particle size were increasing with increased concentration of CeO_2 in host matrix of MgO as exhibited by the XRD and SEM measurements. Moreover, it has been found that the band gap reduces while magnetic character increases with an increase in concentration of CeO_2. Magnetic behaviour of nanocomposites was elucidated on the basis of oxygen intrinsic defect which is confirmed through XPS.
Keywords: MgO, CeO_2, photocatalytic activity, Magnetic Properties.

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Morphology, Barrier and Electrical Properties of Oil-Extended EPDM/Nanographite Nanocomposites

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Nanocomposite was prepared by introducing nanographite as reinforcing filler in ethylene propylene diene monomer (EPDM) matrix in order to form advanced EPDM-based functional nanomaterials which offer various technical applications. The main focus of present work is to improve the mechanical and electrical properties of filled polymer nanocomposites as compared to unfilled polymer nanocomposites. Prepared sample were characterized by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) to determine surface morphology. Effect of reinforcing filler on mechanical properties like tensile strength, elongation at break, toughness and modulus of EPDM nanocomposites was also studied. Electrical behavior has also been studied as a function of frequency and filler loadings.
Keywords: Nanocomposites, ethylene propylene diene monomer, bound rubber and threshold.

ABICNAN2019100627

Thickness Dependent Ultra-Violet (UV) Photoconductivity Studies on Sol-Gel Derived Zinc Oxide (ZnO) Films

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ZnO films of different thicknesses (36 to 231 nm) were deposited by sol-gel technique for UV photodetection applications. Dependence of photoconductivity parameter of UV photodetector, for UV radiation of wavelength 365 nm and intensity of 24 $\mu W/cm^2$, on the thickness of the ZnO films have been investigated. The deposited ZnO films exhibit poly-crystallinity with

significant surface roughness (27 to 100 nm) and oxygen related defects (Oi, Ozn, Vo), which are found advantageous for obtaining enhanced UV photosensitivity.

Keywords: UV photodetector, ZnO film, Sol-gel, Photoluminescence.

ABICNAN2019100628

Modelling the Effect of Crack Formation on the Actuation Behaviour of Ionic Polymer Metal Composite (IPMC)

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In this paper, the effect of different cracks on the electrode material of the IPMC while it undergoes continuous deformation is modelled. The modelling is carried out using a finite element method solver (COMSOL Multiphysics) by coupling electrostatics, transport phenomenon, and solid mechanics. The IPMC is analyzed in a cantilever configuration by fixing it in one end and free at the other. Studies on different shapes of cracks (V, U, and rectangular shapes), dimensions, position on the electrode, the effect of multiple cracks (2 similar shaped cracks, 2 different shaped cracks), presence of cracks on the top/bottom electrode and both in top and bottom electrode are analyzed. The change in the IPMC's resonance frequency and tip deflection for various cracks is studied and compared with the IPMC with no cracks using COMSOL.

Keywords: IPMC deflection, cracks, frequency, COMSOL 5.3a.

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Trial of Pilot Scale Nano Filtration Unit for Improvement of Precipitation Circuit at Tummalapalle Mill

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Uranium Corporation of India Limited (UCIL), a Public Sector Enterprise, under Department of Atomic Energy (DAE), Govt. of India, has constructed and commissioned 3000 TPD of Uranium Ore processing plant in April, 2012.

Alkaline pressure leaching has been adopted in Tummalapalle Uranium Ore processing plant due to high carbonate content to the extent of 85% in the ore. As a process requirement around 70% of the uranium laden liquor obtained from the leached slurry filter is re-circulated for re-pulping of the cake of neutral slurry filter. This concept of recycle of major fraction of leached uranium liquor has been adopted for increasing the concentration of mother liquor from the leached slurry belt filter. A large inventory of such concentrated slurry is thus created in leaching reactor and associated system. The product precipitation efficiency and its settling characteristics largely depend upon the concentration of mother liquor. Increasing the concentration of mother liquor may solve the settling problem after precipitation circuit as settling characteristics may improve.

An effort has been made to increase the concentration of clarified mother liquor using laboratory model nano filtration unit. The reproducibility of the data has been established in

the preliminary experiments. These laboratory results need to be validated at higher level of operation before scaling-up of equipment for its industrial use. These indicative tests points out to the possible increase in concentration of uranium values from 0.5 gpl liquor to about 0.9 gpl. The process can avoid recycle of leach liquors, provides more flexibility in using wash liquors and can work with low values of leach liquor.

This paper deals with trial experiments & results of low grade uranium liquor on Pilot Scale Nano Filtration Skid at Tummalapalle Mill which can be useful for enhanced precipitation efficiency in terms of U_3O_8 recovery enhancement.

Keywords: Uranium, Tummalapalle Mill, Uranium Corporation of India Limited, Nano Filtration Skid, Ultra Filtration, Precipitation, Alkali Leaching.

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Development and Evaluation of Chitosan- Heparin Nanoparticles based Topical Formulation for Treatment of Frostbite

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Frostbite an injury, which occurs on exposure to subzero temperature, leading to severe damage to vasculature, and stunting of blood supply in the damaged tissue resulting in ischemic cellular insult, and further tissue death. Frostbite still leads to severe morbidity. Current research focuses of development of topical nanoparticle formulation for treatment of frostbite. We prepared chitosan-heparin nanoparticles, by simple ionic gelation method. The nanoparticles were formulated as a SCMC based gel. Efficacy of the formulation in treatment of frostbite in wistar rats was evaluated. The nanoparticle formulation was able to produce significantly better results in treated animals in comparison to untreated group the percentage wound healing was significantly higher with complete healing achieved by 19_{th} day in treated group, while Untreated group took 23 days for complete healing The Histopathological results also suggest that the healing in treatment group was significantly higher in the treatment group, in comparison to control group.

ABICNAN2019100634

Towards High Performance Polymer Solar Cell: Polymer-Film Morphology and Device Design Considerations

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Organic conjugated polymers and small molecules and their application in electronic devices like organic light emitting diodes, field-effect transistors and solar cells are thought to have definite advantages over their inorganic counterpart. These devices can potentially be cheaper and also suitable for large area applications. Organic solar cells in particular are being extensively investigated as a promising candidate for alternative energy technology and are now reaching a power conversion efficiency of ~ 10%. In this talk, I will discuss my research activities in this area where I will address few promising strategies to boost the performance of

organic photovoltaic devices. 1. Effect of molecular order on charge transport and photoconductive property: The film-morphology of the polymer-fullerene blend influences the efficiency of a solar cell. Semiconducting polymers are long chain hydrocarbon materials which have a strong tendency to bend, twist and form coils in a solid state film. Under suitable processing conditions; high degree of molecular orientation can be achieved. We investigate whether; a uniaxial orientation of polymer chains in the direction of applied electric field can enhance the performance of the solar cell. A case of uniaxially oriented semicrystalline polymer and its applications in lateral photodiode and field-effect transistor will be discussed in detail. 2. Novel device design and tandem solar cell: Second part of the talk will be focused on fabrication of high efficiency tandem solar cells on optically opaque substrates. Based on theoretical predictions from other groups, the efficiency of polymer tandem solar cells can reach upto 15%. We fabricate and demonstrate first example of an top-illuminated ITO-free tandem solar cell atop a metal surface with efficiency ~ 6%. Top illumination in combination with a structured reflecting metal bottom electrode can also enable future integration of plasmonic or photonic light trapping structures in the metal electrode to enhance light absorption.

Keywords: Polymer, ITO, Fullerene

ABICNAN2019100635

Optical and Anti-Microbial Properties of Nano Ceria Processed Via Surfactant Aided Mechanical Milling Technique

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Presently, nano ceria required for UV resistant coatings, batteries, gas sensors, and H_2 energy generation. In this context, processing of bulk nano ceria via cost-effective routes is extremely essential. Nano scale cerium (IV) oxide is processed from low cost $Ce_2(CO_3)_3$ precursor via direct milling followed by thermal decomposition. The role of different surfactants, calcination temperature and milling time was studied. Ceria/colloidal ceria was also obtained and subjected UV-DRS, PL, NIR analysis, TEM, powder XRD and XPS. Particle size between 300-400 nm was successfully obtained which was tested for anti-microbial studies. It was observed that the colloidal ceria offered more than 95% optical transparency upon coatings and in bulk it uniquely exhibits more than 80% IR reflectance in the region 800 to 1100 nm indicates the material is a candidate for optically transparent, UV resistant, bio safe, IR reflective coatings.

Keywords: Cerium (IV) oxide, Surfactants, Colloid, Planetary Milling.

ABICNAN2019100637

Hydrophobic PVDF-HFP doped with Surfactant Based Electrospun Nanofibrous Layer onto the Hydrophilic Cellulose Acetate Mat for Improved Desalination by Using Fouling-free MD Process

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Membrane Distillation is a vapour-driven thermal method for desalting saline water. In the current study, a unique class of MD process was performed with enriched dual-layer membrane composed of a hydrophilic cellulose acetate filter paper mat and electro spun nano fibrous hydrophobic layer. The electro spun membrane layer was fabricated by polyvinyldene fluoride-co-hexafluropropylene doped with sodiumdodecylsufate /hexadecyl trimethyl ammonium bromide. The membrane quality was examined with FT-IR, SEM contact angle, permeate water flux and salt rejection %. Percent salt rejection of the PVDF-HFP-SDS/CFP membrane was observed between 97-98 %, and a stable water flux of about 7.5 LMH has been achieved for 12 hrs.

Keywords: Electrospun nanofibrous membrane, PVDF-HFP, Surfactants, Fouling reduction

ABICNAN2019100638

Optical Nanoscale Sensors for Perfumery Industries

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Light matter interactions are at the heart of many scientific disciplines, from production methods for engineering catalysis to probing in-situ biomedical systems in a non destructive manner. The optics community has developed a range of experimental techniques to divine information from these systems, and recent advances in our group have pushed the boundaries of ultrafast pulse manipulation for industry. Traditionally considered to be an experimental impediment, the well known thermal lens effect observed when pulsed laser light interacts with semi-transparent liquid media and caused by a change in local refractive index due to competing heat dissipation mechanisms. We reinterpret this as a probe to measure small differences in the local temperature. The perfumery industries typically rely on the diffusional mechanisms and empirical laws during the testing phase, and use human scent testers exclusively, which adds significant time delays as well as production overheads. The ‘accords’ or perfumery primitives are still generated by manual labor, though a qualitative analysis of perfumes is defined by the pyramid shown in Fig. 1. Quantitative estimators are few and far apart, as empirical correlations like the odor value(OV) have to typically account for variations in sociological conditions such and geography, gender and require a large number of trained human specialists. The intractable complexity of multi-component mixture analysis precludes the ability of the equation of state (EOS) methods to aid the industry. Recent studies have shown the utility of this effect as a probe for complex systems. The signal in alcohols is notable as it establishes a strong correlation between the TL signal and physical properties, like mobility, steric effects, and hydrogen bonding. Leveraging thermal lens effects as a control parameter obtained from our ultrafast laser experiments, we have found a clear correlation between our TL data and are able to use this as a quantitative measure to determine the optimal accord concentration. This shall be of immense use to the perfumery industries, and also provides key insights into the interplay of light-matter interactions.

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Design Performance and Analysis of Saw Based Sensors for Dichloromethane Gas Sensing

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A single (polyisobutylene, PIB) and multi- (polyisobutylene/Silicon nitride, PIB/Si_3N_4) surface acoustic wave based sensors were designed on $LiNbO_3$ piezoelectric substrate. The designed models patterned with interdigitated transducer (IDT) aluminum (Al) electrodes were used to analyze gas sensing behaviour for dichloromethane (DCM) gas. The studies for DCM gas sensing were carried out for single and multi-layer models using COMSOL Multi-physics software. The resonant frequency and displacement were observed for 100 ppm gas concentration of DCM at room temperature. It was found that multi-layer designed model has shown higher sensitivity as compared to single layer (PIB/$LiNbO_3$) model on exposing of DCM gas. The effects on sensitivity of sensor with variation in temperature and spacing layer thickness were also studied.
Keywords: Polyisobutylene, Silicon nitride, SAW sensor, COMSOL, dichloromethane gas sensing

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Influence of Synthetic Parameters on the Enhanced Photocatalytic Properties of ZnO Nanoparticles for Organic Dyes Degradation: A Green Approach

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The morphology, particle size and optical properties are considered as an important factor for the improvement of photocatalytic efficiency of ZnO nanoparticles formed from zinc oxide. Herein, we report a globally benevolent green synthetic strategy with aqueous leaves extract of *Actinodaphne madraspatna* Bedd (AMB) for the synthesis of ZnO NPs. The physical shape, size, morphological and optical properties of the synthesized ZnO NPs are well characterized through Ultraviolet-Visible diffuse reflectance spectroscopy (DRS UV), X-ray diffraction (XRD), Raman spectroscopy and transmission electron microscopy (TEM). Optical studies of prepared ZnO NPs showed the band gap values are reduced in the range of 3.05 to 2.96 eV. The XRD data revealed the synthesized ZnO NPs exist in Wurtzite crystal structure with crystallite sizes of 18 nm to 68 nm range. The obtained results showed that the band gap and crystallite nanometered ZnO NPs would be achieved by changing the parameters, while the process of ZnO NPs was synthesized in a greenly method. In addition, the green synthesized ZnO NPs were examined for the photocatalytic degradation of methylene blue (MB) and acid violet 17 (AV17) dyes under UV light and rate constant 'k' was calculated. It is found that the enhanced photocatalytic activity with higher 'k' value is mainly dependent on the reduced band gap and crystallite size of green synthesized ZnO NPs.
Keywords: Green synthesis; zinc oxide nanoparticles; photo catalysis; rate constant; band gap; crystallite size

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Optical Waveguide Design for the Enhancement of Photon Collection Efficiency in Nitrogen Vacancy Center in Diamond

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We present the design and theoretical simulation of a micro range waveguide with an elliptical solid immersion lens (e-SIL) in a diamond substrate based on nitrogen-vacancy center in diamond. We have varied the numerical aperture of the lens in a range between 0.4 and 0.94 and collected photons with a maximum collection efficiency of 83.3%. The far field variations have been studied over a wide range of emission spectra of nitrogen- vacancy center in diamond. This highly efficient single photon emitter has a wide range of applications in the field of nanoscale magnetic sensing and quantum information devices.
Keywords: NV diamond, collection efficiency, SIL.

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Metal Oxide Based Nanocomposites in Hexavalent Chromium Removal

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The present investigation highlights nanocomposite of metal oxides in the removal of hexavalent chromium. Metal oxides of steel slag are sintered at 600°C and the removal of chromium has been studied using Di-Phenyl Carbazide ($C_{13}H_{14}N_4O$) method by UV–vis Spectrophotometer. Cr (VI) removal is studied with various parameters such as pH, initial concentration of Cr (VI) solution, metal oxides dosage and contact time. Elemental composition and surface morphology of steel slag (metal oxides) is characterized using EDAX, XRF and SEM analysis respectively. Atomic absorption spectroscopy (AAS) is emphasized for the total chromium content of pre- and postremoval.
Keywords: Nanocomposites, metal oxides, steel slag, hexavalent chromium, waste water treatment.

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Biosynthesis of CuO Nanoparticles Using Microwave Assisted Carissa edulis Fruit Extract and it's Biological Aspects

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The main focus of this study is synthesis of Copper oxide nanoparticles by introducing microwave extracted *Carrisa edulis* fruit as a fuel by conventional Ultrasonic irradiation method, their characterization and examination on biological activities. The results obtained from X-ray diffraction studies proved that the particles are monoclinic by nature. The blue shift with increase in fruit extract concentration is evident from UV–visible absorption spectrum of CuO NPs. Spherical nature of the particles is observed from the obtained SEM images. Even

TEM images show the spherical shape of the particle and also the size which is of 25-30 nm range. The FT–IR analysis suggests that the obtained CuO NPs have been stabilized through the interactions of steroids, terpenoids, flavonoids and phenolic acids present in the fruit extract. This study gives many benefits like eco-friendliness and is also suitable for biomedical usages.

Keywords: Biosynthesis, Microwave, Ultrasonic irradiation, TEM and spherical shape.

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Analysis on Size Reduction of AgNPs Loaded Hydrogel and its Effect on Anti-Bacterial Activity

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This paper focuses on analysing the effect of size reduction of Ag loaded hydrogel using a) lyophilisation b) ball milling and its anti-bacterial activity. The first step involves the loading of Silver (Ag) nanoparticles into the hydrogel. The SEM analysis reveals that the size reduced Ag loaded hydrogel using lyophilisation (S1) of particle size (4.5-6.5) μm whereas ball milling (S2) yields a size of (0.4-0.9) μm. The pH analysis on S1 and S2 shows that swelling ratio of lyophilised reduced AgNP loaded hydrogel increases with increase in pH standard values. Compared to this swelling ratio of Ag loaded and ball milled AgNP loaded hydrogel is decrease with pH increase. The tests on the anti bacterial activity shows that a zonal of 0.5 cm, 0.3 cm and 0.25 cm diameter for Ag loaded hydrogel on E-coli and S. aureus bacteria and lyophilisation reduced Ag loaded hydrogel on S. aureus bacteria

Keywords: Ag loaded hydrogel, lyophilisation, ball milling, pH sensing, anti-bacterial.

ABICNAN2019100669

Photocatalytic Study of Phytofabricated Copper Oxide Nanoparticles Against an AZO Dye and Its Kinetics

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For the emerging environmental hazards and pollution posed due to the use of toxic dyes in industries, photocatalysts are a boon. Phytofabrication, considered as a much greener and safer method for preparing nanoparticles (photocatalysts), have been of great interest for researchers. In this study, we synthesized copper oxide nanoparticles (CuO NPs) utilizing an agricultural waste. *A. hypogaea* fabricated CuO nanoparticles (which is not reported yet) were characterized using UV-visible spectroscopy, XRD, FTIR, HRTEM and EDAX. In addition photocatalytic degradation activity of the CuO NPs was evaluated using Congo red dye with UV light. Thus we have fabricated a good photocatalyst which exhibited better percentage of degradation of Congo red dye.

Keywords: Photocatalyst, *Arachis hypogaea*, CuO NPs, Photocatalytic degradation

ABICNAN2019100670

K Nearest Neighbour and LSTM for Semiconductor Device Classification with Improved Precision

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Manufacturing of Chips without defects is a major challenge in Semiconductor industry. Classification of semiconductor wafers as defective items has been increasingly explored by researchers since long. K-Nearest Neighbour and Long Short-Term Memory classification techniques have been used to classify the semiconductor dataset. Long Short-Term Memory Networks with one hidden layer has been constructed to develop the classification model. An improved Machine Learning based prediction model based on clustering technique has been proposed in this paper. Experimental results have shown improvements in precision and accuracy when compared to other Machine Learning algorithms investigated in the paper.
Keywords: KNN, LSTM, Semiconductor, Machine Learning.

ABICNAN2019100677

Influence of Nickel Dopant Concentration on Structural, Optical, Magnetic and Electrochemical Properties of TiO_2 Nanoparticles

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In this work, we report enhanced photocatalytic and magnetization effects obtained with the nickel (Ni) doped Titanium di oxide (TiO_2) nanoparticles. The nanocrystalline TiO_2 doped with different concentrations of Ni (0.05-0.2%) were prepared by sol-gel method and characterized by various analytical techniques such as X-ray diffraction (XRD), UV-Vis spectroscopy, Scanning Electron Microscopy (SEM) and Vibrating Sample Magnetometer (VSM). The Ni metal ions incorporation modified the microstructure of TiO_2 nanoparticles significantly which are evident from XRD and SEM analyses. The band gap reduction made by the Ni impurity level extends the TiO_2 absorption edge to visible region. The photocatalytic activity of TiO_2 and Ni– TiO_2 was studied by photo degradation of methyl orange dye as a function of irradiation time under visible light. The results indicate that TiO_2 nanoparticles doped with the higher of concentration of 0.2% Ni improves the reaction rate of hydroxyl radical production. The electrochemical behavior of the prepared samples was analysed by cyclic voltammetry study. The existence of ferromagnetic phase with the enhanced magnetization in Ni doped TiO_2 samples make this as an appropriate material for potential applications in spintronic and magneto-electronic devices.
Keywords: Sol–gel process, TiO_2, Ni doped TiO_2, Photocatalytic activity.

ABICNAN2019100684

Photocatalytic Degradation of Rhodamine-B using Nanosized Ag_2S–ZnS Loaded on Cellulose

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In the present work, new visible light active nanosized Ag_2S-ZnS loaded on cellulose (AZCE) was synthesized by hydrothermal method. The as-synthesized AZCE composite was systematically investigated by XRD, SEM, TEM, BET, and UV-visible spectroscopic techniques. The activity of the photocatalysts was evaluated for rhodamine B dye (RhB) degradation under simulated sun light. Effect of reaction conditions such as pH, catalyst, hydrogen peroxide and dye concentration on the photodegradation rate has been investigated. The oxidation data indicates that dye can be most effectively oxidized at a pH of greater than 4, dye concentration (60 mg/L) and catalyst concentration (30 mg). The AZCE catalyzed oxidation of RhB dye follows first-order kinetics and rate constant value of $6.4x10^{-3}$ min-1. Various organic intermediates were identified by high performance liquid chromatography (HPLC), total organic contents (TOC) and electron-spray ionization-mass spectrometric (ESI-MS) study during photodegradation process of RhB. The superior visible light photocatalytic performances for composites were due to their composite structure and the synergistic effects between Ag_2S-ZnS and cellulose. The possible mechanism of AZC catalysed photodegradation of RhB products is proposed.

Keywords: Photocatalytic, Rhodamine B, Ag_2S.

ABICNAN2019100689

Linear and Nonlinear Optical Properties of ZnS/Ag_2S Composite Nanoparticles

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A nanocomposite is a multiphase solid material where one of the phases has one, two or all the three dimensions less than 100 nm, or structures having nano-scale repeat distances between the different phases that make up the material. Presently the synthesis and characterization of composite nanoparticles is an important research area at the frontier of advanced material science. Nonlinear optical (NLO) materials have also received considerable attention as a result of growing demand for the protection of optical sensors. Nonlinear optics has drawn increasing attention from researchers because of its potential applications in optical switching, optical data storage, optical communications, and eye and sensor protection. In the present study**,** we have chosen Ag_2S to coat on nanoparticles of ZnS and the nonlinear optical properties of ZnS/Ag_2S composite material have been studied.

Among a variety of preparation methods for nanoparticles, the most popular one is the wet chemical synthesis. The Z-scan technique employed for NLO characterization is a very simple but authoritative technique to measure the third order optical nonlinearity of materials. In this article, we present the synthesis and linear and nonlinear optical characterization of ZnS/Ag_2S composite nanoparticles. We report the observation of strong nonlinear absorption by ZnS/Ag_2S at 532 nm, when 5 ns laser pulses were used for excitation. Also, we have investigated the optical limiting property of ZnS/Ag_2S nanoparticles and determined the composition at which the material has maximum limiting property.

Keywords: ZnS, Ag_2S, NLO, Nanocomposite.

ABICNAN2019100690

Characterization and Evaluation of Epoxy Resin Composites Reinforced with Different Multi-Walled Carbon Nanotube Concentration: Tribological and Mechanical Performance

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The discovery of multi-walled carbon nanotubes (MWCNTs) generated a new perspectives in many fields of science and technology. MWCNTs are increasingly attracting scientific and industrial interest due to their outstanding characteristics. Epoxy/MWCNT composites are increasingly used for engineering applications under hard working conditions due to unique mechanical properties of MWCNTs, such as high elastic modulus, tensile strength and strain to fracture, ability to withstand cross-sectional and twisting distortions, compression without fracture, combined with a low specific weight and high resistance to degradation in order to ensure safety and economic efficiency. The objective of the current research is focused on the producing of epoxy-nano composites reinforced with different concentrations of multi wall carbon nanotubes (MWCNTs) content and investigation of their tribological and mechanical performance. Epoxy/carbon nanotubes were prepared by the mixing method ultrasonic cell crusher. The properties of epoxy/MWCNT composites strongly depend on homogeneous and uniform distribution of MWCNTs in the epoxy matrix. The composite samples with different volume fractions were prepared by using the compression moulding process at room temperature. The samples were subjected to different mechanical testing such as tensile strength, elongation at break, tensile modulus, flexural strength, flexural modulus, impact strength and hardness loading as per respective ASTM standards. It was found that the mechanical performance of MWCNTs/epoxy composites were improved significantly with the addition of MWCNTs. The combination of chemical functionalization of MWCNTs and high energy sonication is a useful approach to improve the dispersion state of the CNTs and the interfacial adhesion to the epoxy matrix. The tribological properties of epoxy-MWCNTs nano composites were investigated using “pin-on disc” wear testing machine under different conditions. Combining epoxy resin with MWCNTs is an efficient method to improve the wear resistance of epoxy resin. Scanning electron microscopy (SEM) were used to observe the worn surfaces of the samples. Compared with neat epoxy, the composites with MWCNTs showed a lower mass loss, lower friction coefficient and wear rate, and these parameters decreased with the increase of MWCNT percentage. The results obtained with the investigation can be adopted for the successful implementation in various industrial applications.

Keywords: Epoxy; Multi Walled CNT; Composites; Dispersion; Tribology; Industry.

ABICNAN2019100693

In Situ Tuning of Band Gap of Sn Doped Composite for Sustained Photocatalytic Hydrogen Generation under Visible Light Irradiation

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Influence of Sn doping on the photocatalytic properties of Iron/titanium nanocomposite for enhanced photocatalytic hydrogen generation is investigated. The nanocomposite modified by Sn^{4+} dopant acts as a suitable photocatalyst for induced visible light absorption, facilitating pronounced charge separation efficiency. Heterojunctions formation of hematite Fe_2O_3 with anatase-rutile mixed phase of TiO_2 by means of Sn doping is achieved. Tuned band gap of 2.4 eV favoured visible light absorption. A hydrogen generation activity of 1102.8 μmol $(5\ h)^{-1}$ is achieved with the doped system, nearly five times higher than the bare system (261.5 μmol $(5\ h)^{-1}$). High crystallinity, low band gap, low recombination rate of photogenerated charge carriers, and high visible light absorption efficiency enhanced the photocatalytic activity.
Keywords: Photocatalysis, Hydrogen, Water splitting, TiO_2

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Analytical Characterization of Color Changing Waste Polystyrene Plastic

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Dissolution with solvent is one of the cost effective and easier process for utilization of transparent polystyrene plastic waste. In this work solubility of waste transparent polystyrene plastic waste into aliphatic hydrocarbon solvent has been determined. Experimental results has shown to develop a white material. The solubility of waste transparent polystyrene plastic sample was investigated through Fourier transform infrared spectroscopy (FTIR), optical microscopy, Scanning Electron Microscopy (SEM) measure the contact angle and differential scanning calorimetry (DSC).Therefore utilization of transparent polystyrene plastic waste is possible and dissolution recycling technique approach is an economical method for utilization of waste polystyrene plastic.
Keywords: Polystyrene, Solvent, Solubility, White, Utilization, Dissolution.

ABICNAN2019100697

Porous Graphene-$NiCo_2O_4$ Nanorod Hybrid Composite as High Performance Supercapacitor Electrode Material

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Template free low temperature solvothermal synthesis of high capacitive porous graphene-$NiCo_2O_4$ nanorod composites has been carried out. Solvothermal synthesis, followed by calcination in air led to development of highly porous hybrid nanocomposite which acts as a buffering channel for fast ion diffusion and provides robust mechanical strength. Advantages of using porous graphene to enhance the capacitance of the material were studied theoretically

using first principles calculations. High capacitance value of 1533 F g^{-1} at a scan rate of 5 mV s^{-1}, and 1684 F g^{-1} at a current density of 1 A g^{-1} are obtained from cyclic voltammetry data and galvanostatic charge discharge data, respectively. The electrode material possesses good rate capability with retention of 94 % of its initial capacitance even after 10000 charge-discharge cycles at a current density of 8 A g^{-1} in 2 M KOH electrolyte. The fabricated supercapacitor exhibited high energy density of 45.3 Wh kg^{-1} and high power density of 17843.5 W kg^{-1} due to the synergistic effect of the composite components. The enhanced electrochemical function of the composite makes it a potential candidate for supercapacitor application and future studies.

Keywords: Porous graphene, $NiCo_2O_4$ nanorods, supercapacitor, cyclic voltammetry, energy density.

ABICNAN2019100699

SERS-Based Sensor Substrates for Detection of Explosives

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Ever since the innovation of the surface-enhanced Raman scattering (SERS) based detection techniques, there has been a number of ways of fabricating substrates for the same. The noble metal nanostructures have offered remarkable electromagnetic enhancement, though the durability and reusability of substrates in most cases is debatable. We report the fabrication of metallic nanostructures on silicon substrates for highly sensitive surface enhanced Raman spectroscopy (SERS)-based sensors. This paper discusses the design and testing of a new class of SERS substrates specifically designed to optimize Raman scattering enhancement while also affording exceptional roughness and reversibility of response under challenging conditions. Substrate templates are fabricated on a silicon oxide surface, then silver nanostructures are drop casted. Analytes are measured in flowing streams of airborne vapour and aqueous liquid. Our SERS substrates are capable of detecting chemicals adsorbed 4-mercaptobenzoic acid and 2,4-dinitrotoluene at a concentration as low as 10 ppm with a reproducible SERS factor 5 times enhancement in the magnitude of signals of analyte molecule. The detection was extended to vapours of TNT and other explosives. The reproducibility was checked by degassing the substrates and further bringing in contact with the analyte. The substrates showed similar performance even after multiple cycles of adsorption and desorption.

Keywords: SERS, 4-mercaptobenzoic acid and 2,4-dinitrotoluene.

ABICNAN2019100701

The Antifungal and Antiovarian Cancer Propertiesof α- Fe_2O_3 and Core-Shell α- Fe_2O_3 -ZnO nanostructures Synthesized by Spirulina platensis

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Candida albicans infection is a growing burden of human health, and with the incidence of cancer, it has become challenging to search for treatment. In our study, α-Fe_2O_3 NPs and core-shell α-Fe_2O_3 @ ZnO structures were fabricated by using the water extract of cyanobacterium Spirulin platensis. Structural, Morphological, and the nature of the surface functional group of these NPs have been carried out. Minimum fungal Inhibitory concentrations for these NPs were 100μg/ml by using the broth dilution method and recording the Optical density of these nanostructures. Cytotoxicity was estimated through MTT assay against Human ovarian PA1 cell lines. α-Fe_2O_3 NPs and core-shell α-Fe_2O_3 @ ZnO structures showed potent anticancer activity against PA1 owing to the DNA fragmentation of cancer cells.
Keywords: α-Fe_2O_3 –ZnO composite, Spirulina platensis, Anticandidal, Anticancer Activity.

ABICNAN2019100706

Polymeric Microspheres as a Drug Carrier for Sustained Release of Metformin Based on Miscibility Study

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Metformin (Met) loaded eudragit (Eu)/chitosan (CH) microspheres prepared by ionic gelation method in order to control the release of drug. The weight ratio of individual polymers is ascertained based on polymeric blend miscibility compositions (3:7, 2:8, 1:9). Microspheres are analyzed for surface morphology, swelling behavior and subjected to in vitro dissolution test and release kinetics. Dissolution result reveals that Eu+CH (1:9) ratio shows complete release (92.99% in 12h) as compared to microspheres prepared by individual polymers. Eudragit based microsphere shows incomplete release (77% in 12h) but chitosan, due to high swelling nature shows early release (92.39% in 9h). The release kinetics follows combined effect of diffusion and erosion mechanism.
Keywords: Eudragit, Chitosan, Miscibility blend, Sustained release, Antidiabetic.

ABICNAN2019100707

Ethylbenzene Oxidation Using Cobalt Oxide Supported Over SBA-15 AND KIT-6

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Oxidation of hydrocarbons is industrially important for the manufacturing of a variety of oxygenates that are commercially used in the preparation of fragrances, polymers and pharmaceuticals. Oxidation of ethylbenzene results in the formation of acetophenone, benzaldehyde, and benzoic acid. Present study is focused towards exploring cobalt over mesoporous silica support as catalysts for ethylbenzene oxidation with an intention to improve conversion and selectivity of products. Cobalt of different loadings (2-10%) is supported on SBA-15 and KIT-6 by wet-impregnation. The prepared catalysts were characterized by Fourier Transform Infrared (FTIR) Spectroscopy, X-Ray Diffraction (XRD), Brunauer-Emmet-Teller (BET) surface area analysis, and Scanning Electron Microscope (SEM). Catalyst performance was evaluated for the oxidation of ethylbenzene using 70% tert Butyl Hydrogen Peroxide

(tBHP) as the oxidant and acetonitrile as the solvent. The effect of change of support and catalyst loading was studied. A highest conversion of 37.11% is observed for 2% Co/SBA-15. It is observed that the catalysts with KIT- 6 as support show a higher selectivity to acetophenone than the catalysts supported on SBA-15.

Keywords: Ethylbenzene, oxidation, SBA-15, KIT-6, cobalt oxide, benzoic acid.

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High-Throughput Extraction of Dendritic Cells for Cancer Immunotherapy Using Inertial Microfluidics

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Freshly isolated naturally circulating dendritic cell (DC) may be more suitable to the development of immunotherapy regimes to eliminate tumor cells in metastatic cancer. A principled design of collection outlets for inertial separation devices is proposed in this work, which can collect closely-spaced and focused particle streams having close size differences and can easily be scale to an arbitrary number of collection channels without constraining the outlet channel width. The device was demonstrated to isolate dendritic cells from the blood cell mixture at a high recovery rate of ~90% with throughput up to 1.9 ml/min. More than 86% of dendritic cells remain viable, which is extremely important when DCs and other blood cells are injected back into the patient's body after performing downstream analysis. Isolation of DCs from the blood cell mixture using microfluidic technology was demonstrated for the first time and has shown the pathways to apply in novel cancer treatment and research with high enrichment ratio of DCs at low cost and reduced analysis time.

Keywords: Dendritic cell, immunotherapy, inertial microfluidics, label-free, high-throughput.

ABICNAN2019100714

Simultaneous Removal of Methylene Blue and Heavy Metals from Water Using Zr-MOF having Free Carboxylic Group

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Industrial effluents contain multiple pollutants which affect the quality of water remediation operations. Hence it is important to understand the outcomes of the multicomponent adsorption system to develop efficient decontamination process. In this work, acid assisted hydrothermal method was employed to synthesize Zirconium based MOF and utilised for the adsorptive removal of methylene blue (MB) dye and heavy metals (Lead and Cadmium) from aqueous solution. The adsorbent was characterized by Powder XRD, BET surface area, FTIR, XPS and SEM analysis. Effects of various parameters on adsorption were evaluated. Kinetics was better explained by Pseudo Second-order model and adsorption by Langmuir isotherm.

Keywords: Metal-organic frameworks, Methylene blue, Heavy metals, Multicomponent adsorption.

ABICNAN2019100716

Strength Properties of Graphene Oxide Cement Composites

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Ordinary Portland Cement (OPC) is the key ingredient in concrete, and it is the primary choice in construction and building environment. Emerging multi-functional materials have gained popularity by incorporating into OPC due to its excellent engineering properties. OPC resembles poor resistance to crack formation, low tensile strength, and strain capacity due to its brittle nature. Graphene and its derivatives like Graphene Oxide, Carbon Nano Fibres, Carbon Nano Tubes, and silica particles shown a pathway in forming a super concrete by their extraordinary mechanical properties. Graphene oxide directly interacts with cement particles due to its excellent interfacial interaction properties. This paper represents the research on enhanced traditional concrete properties with Graphene Oxide. Nano structural properties and variations in hydration of cement are investigated by XRD, and AFM analysis. Addition of Graphene oxide to cement provides new aspect in understanding silicate hydrate phase changes. This will provide a potential for Nano Technology challenges in construction industry and energy consumption reduction.
***Keywords**:* Graphene Oxide; Nano composites; Cement; Mechanical properties; Micro structural Characteristics.

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Effect of Surface Lattice Vibration on the Specific Heat Enhancement of Nanoparticles by Molecular Dynamics Simulation

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Literature reports nonconforming results of heat capacity for nanostructures. The origin of such discrepancy remains unclear. This work proposes a better understanding of heat capacity enhancement in model systems through soft surface phonons. This paper will also validate the surface driven phase transition in model Lennard-Jones and Yukawa systems.
Keywords: Nanoparticles, Surface Phonons, Molecular dynamics (MD).

ABICNAN2019100719

Creep Behaviour of Graphene Nanoparticles Reinforced Squeeze-Cast AZ91 and AZ91-Ca Magnesium Alloys

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Magnesium (Mg) matrix nanocomposites have been developed because of their high modulus, high strength, superior creep and wear resistance than their alloy counterparts. This work investigates the effect of graphene nanoparticles (GNPs) additions on creep response of the

squeeze-cast AZ91 and AZ91-Ca alloys. The graphene reinforced AZ91 and AZ91-Ca alloy revealed superior creep resistance than the AZ91 alloy and the AZ91-Ca-GNPs exhibits the highest creep resistance. The improved creep behaviour of the nanocomposites is attributed to the decrease in the quantity of β-Mg17Al12 phase, a high amount of thermally stable Al2Ca phase along with the strengthening provided by the GNPs.

Keywords: AZ91 magnesium alloy; Nanocomposites; Creep resistance; Scanning electron microscopy (SEM).

ABICNAN2019100723

Compression and Fracture Behaviour of Leather Particulate Reinforced Polymer Composites

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Strategies are suggested for waste utilization of industrial leather by preparing composites with epoxy and high-density polyethylene (HDPE). Addition of leather to epoxy improves the average specific compression toughness of epoxy increases by 29%. The fracture surface analysis suggests the incorporation of leather microparticles has led to a transition of epoxy from brittle to ductile. In addition, the dynamic strength of leather/epoxy composite is found to be 69% higher than that of neat epoxy. However, no significant changes are observed when HDPE is infiltrated with leather. Apart from dispersing the leather particles directly in polymer, a novel strategy is presented here in which leather/HDPE microfibers are prepared and then used to reinforce the epoxy matrix. The specific compression modulus of this composite blend is 8% and 65% higher than epoxy and HDPE, respectively. Fractography is further carried out on the failed specimens to understand the failure mechanism in each composite.

Keywords: Leather waste, Epoxy, HDPE, Fracture, Compression

ABICNAN2019100728

Shape Controlled Synthesis of Hydroxyapatite Using *Tridax Procumbens* Linn. for Biomedical Applications

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Hydroxyapatite (HAP) displays excellent biocompatibility and used for tissue engineering and drug delivery applications. In this article, we have presented a facile protocol for the synthesis of HAP using the leaf extract of *Tridax procumbens* Linn. with calcium nitrate and dipotassium hydrogen phosphate as precursor materials. Electron microscopic analysis and powder diffraction studies have been employed to study the surface morphology and the phase purity of the synthesized HAP. Infrared spectroscopic analysis was also carried out to confirm the

functional groups involved in the formation of the HAP. The results suggest that the concentration used for synthesis greatly influences the shape and structure of the particles.
Keywords: hydroxyapatite; microscopy; infrared; spectroscopy; functionalization

ABICNAN2019100729

Removal of Anionic Dye EBT Using Nanocomposites Derived from Slag

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The present investigation highlights, removal of anionic dye EBT from aqueous solution using nanocomposites derived from Induction Furnace (IF) steel slag. Silicon, Iron, Aluminum, Manganese, Calcium are the major elements present in IF steel slag with some traces. The nano sized metal oxides of slag sample are subjected to thermal activation. Removal of EBT dye is studied using UV-Vis spectroscopy. Nanocomposite dosage, initial dye concentration and pH with various contact time were studied. Surface morphology of the nanocomposite is studied using SEM. Structural studies of nanocomposites (core-shell formation) pre- and post- dye removal is analysed using FTIR.
Keywords: Steel slag, Nanocomposites, Eriochrome Black-T, Ion exchange; Waste water treatment

ABICNAN2019100730

Organic Flurophore Free Blue Fluorescent Carbon Nano-Dots for Arsenic Sensing

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Herein, novel strategy was implied for developing fluorescent sensor for As (III) using glutathione (GSH) modified organic flurophores free carbon nanodots (CNDs) synthesized by facile microwave assisted protocol. The purification step for CNDs was established through multiple solvent treatment techniques. The prepared pure CNDs were successfully characterized by optical and surface morphological studies, and further applied for high sensitive and selective detection of As (III). Moreover, it was found the effect of organic flurophores on As(III) detection while using CNDs with organic flurophores or extraneous impurities. Nevertheless, the improved separation protocol facilitated an enhanced detection of 0.8 ppt As (III).
Keywords: Fluorphores, Glutathione.

ABICNAN2019100731

Microwave Assisted Synthesis of Ag-RGO nanocomposite for Non-Enzymatic Pyruvic Acid Sensing

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Pyruvic Acid (PA), an organic acid not only plays an important role in metabolic pathway of living organisms, but also in monitoring flavor and odor in food industry. Herein, we report synthesis of silver nanoparticles decorated reduced graphene oxide (Ag-rGO) by microwave assisted technique, and the fabrication of disposable non-enzymatic electrochemical sensor for pyruvic acid. The as-synthesized nanocomposites were characterized by surface morphological studies, such as UV-Vis, SEM, EDS and XPS. The Ag-rGO modified electrode exhibited excellent electrochemical activity towards non-enzymatic detection of PA with LOD of 0.5 nM, and could detect the same in spiked and real samples.

Keywords: Graphene oxide, Silver nanoparticles, Pyruvic acid, Non-Enzymatic Sensing, Differential pulse voltammetry.

ABICNAN2019100740

Interfacial Properties of Different Grades of Epoxy Reinforced with Carbon Fiber

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Due to the high specific stiffness, specific strength and corrosion resistance, carbon fiber polymer composites (CFRPs) are widely used in industries such as aerospace, military, automobile and sports. The mechanical performance of CFRPs is influenced not only by the properties of fiber and that of matrix, but also on the interfacial adhesion between the fiber and matrix. To this end, it becomes necessary to know beforehand the strength and toughness requirements of a particular application. In the present study, the interfacial interaction between the carbon fiber and epoxy is investigated in terms of the interfacial shear strength (IFSS) and interfacial fracture toughness (G*ic*) from the view point of strength and fracture toughness requirements of structural applications. The effect of fiber sizing, loading rate, and polymer type on the IFSS and G*ic* are investigated by carrying out micro-droplet debond tests. In order to investigate the effect of fiber surface treatment, two types of composites are prepared by reinforcing epoxy with as-received and unsized carbon fiber. Both these composites are tested at crosshead speeds of 0.005 and 0.5 mm/min and the interfacial parameters IFSS and G*ic* are measured. It is observed that epoxy reinforced with unsized fiber possesses higher IFSS as compared to epoxy reinforced with as-received fiber. Moreover, both IFSS and G*ic* are found not to be constant but dependent on the crosshead speed at which the samples are tested. Comparisons are also made between the IFSS of CFRPs processed with two types of epoxy viz. epoxy polyamide and epoxy polyamine.

Keywords: Carbon fiber polymer composites, interfacial shear strength and interfacial fracture toughness.

ABICNAN2019100741

Synthesis, Characterization and Its Green Catalytic Application of Carbon Dioxide Decomposition over $AlSiO_4 - 5$ And $AlSiO_4 - 12$

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Many researchers have focused either decomposition or sequestration of CO_2, to reduce the carbon dioxide content down to 260 ppm in the atmosphere, since the increase of CO_2 level in the atmosphere will cause severe climatic changes. Many methods are developed and applied for the same, but in most of the methods, they have used high pressure, voltage and temperature these are the main drawbacks in earlier methods. In this paper, nanoporous solid acid catalysts are synthesized & characterized by various spectroscopic techniques to confirm the formation of the material and it is applied for carbon dioxide sequestration.

Keywords: Nanoporous, solid acid catalyst, $AlSiO_4$, CO_2, decomposition.

ABICNAN2019100745

Fabrication of Functionally Graded Polyurethane Foams for Energy Absorption Applications

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Due to diverse application of functionally graded materials (FGMs) ranging from aerospace, pressure vessels to body protection the FGMs are gaining attention. The polyurethane (PU) foams have a density in range of 11 kg/m^3 to 60 kg/m^3 [1]. If PU foams are graded based on density they can further extend their range of application. To this end the PU are foamed in mold of varying geometry viz. conical shape mold (cone angle of 70 and 81^o), cylindrical mold. The end conditions of mold are also varied. Further, for comparison purpose PU foam is also foamed in cylindrical mold again under similar conditions of top end (i.e. closed and open). The substantial gradient in density is produced with conical mold (when foaming direction is from base to apex). Furthermore, the cyclic compression at a strain rate of 0.02 s^{-1} reveals difference in mechanical properties as a function of location within sample.

Keywords: Functionally graded, Polyurethane foams

ABICNAN2019100750

Zinc Oxide Nanostructures Prepared by Modified Ultrasonication-Combustion Method For Optoelectronic Device Applications

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In this work, eco friendly simple modified ultrasonication-combustion method has been adopted to synthesize Zinc Oxide Nanoparticles using naturally available Vitis vinifera fruit and Aegle marmelos L. leaves extracts. The synthesized Zinc Oxide Nanoparticles samples show hexagonal wurtzite crystalline phase confirmed by Powder X-Ray Diffraction patterns. Scanning Electron Microscope gives images of Surface morphology of the samples. The Energy Dispersive X-Ray Spectroscopy gives elemental composition of the prepared samples.

From Ultra-Violet-Near Infrared studies, energy band gap calculated correlates with the reported literature. Fluorescence emission studies shows the prepared samples emissions are in the blue region useful in optoelectronic devices and light emitting diodes.

Keywords: Zinc Oxide, Ultrasonication-combustion, Nanoparticles.

ABICNAN2019100753

Growth of Glomerulus 3-Dimentional MoS_2-PANI Nanofiber for High Electrochemical Catalyst

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The preparation of few layered 3-D material MoS_2-PANI nanofiber composite synthesis via Hydrothermal process, this composite high efficient and active catalyst for the electrochemical performance, MoS_2-PANI nanofiber prepared composite sample were characterized via Fourier-transform infrared (FTIR) spectra to study the chemical composition and formation of bonds, optical properties examine by the UV-visible spectra obtained both UV and Visible region, the elemental analysis examined through EDX, formation of nanosheets and nanofiber surface morphology carried through Field emission scanning electron microscopy (FESEM) and Transmission electron microscopy (TEM),electrochemical techniques were investigated to using Cyclic voltammetry, and Electrochemical catalytic activity were evaluated from EIS obtained resistance is 877 Ω,636Ω and 333Ω respectively ,Linear sweep voltammetry, CV peak reached maximum oxidation current is 2.72 ×10-4 in Amperes and curve appeared between -4.5 to 4.5V Finally MoS_2-PANI-1 nanofiber composite electrochemical performance achieved excellent.

ABICNAN2019100754

High Performance Supercapacitors of Graphene Quantum Dots Polymer Nanocomposites

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A water soluble graphene quantum dots are synthesized by hydrothermal method. Graphene quantum dots polypyrrole nanocomposites(PGC) are prepared by chemical oxidation polymerisation method. The performance of supercapacitor was analyzed by using cyclic voltammetry (CV), galvanostatic charge discharge curves (GCD) and electrochemical impedance spectra (EIS) and Nyquist plot. It is observed that PPY-GQDs supercapacitors exhibited maximum specific capacitance of 790.3 F/g. The electrochemical properties of the supercapacitor with high flexibility and stability are enhanced by optimizing the concentration of electrically conductive substance like polymer gel and increase in the concentration of GQDs.

Keywords: polypyrrole graphene quantum dots composite; charging discharging; impedance spectra.

ABICNAN2019100755

Single Crystalline Hierarchical SnO_2 Microsphere and Fluoride-Mediated Hollow Structures for Photocatalytic Activity

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The present research study deals with the preparation of tin oxide (SnO_2) nanostructures hierarchical hollow microspheres and composed of oriented aligned cone-like SnO_2 nanoparticles are prepared by a hydrothermal route using either NH_4F as morphology controlling agents. The samples were morphology characterized by FE-SEM with diameter of about 2μm to 50nm and XRD showed a homogeneous distribution of quite small grains over scanned area. The optical properties were studied using UV absorption and its optical band gap value is 3.9eV. The electrochemical performance of SnO_2 tested to determine the oxidation/reduction processes by cyclic and linear sweep voltammetry.
Keywords: SnO_2 microsphere; hydrothermal method; photo catalytic.

ABICNAN2019100757

Titanium Dioxide as a Photocatalysis to create self-cleaning concrete

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The use of Titanium Dioxide (TiO_2) in the form of Ultrafine particles as a coating for concrete pavement have received considerable attention in recent years as these particles can trap anti compose organic and inorganic air pollutant by photocatalytic process. In spite of these promising benefits, durability and resistance to wear a of TiO_2 coatings has not been evaluated. The objective of this study is to determine photocatalytic effect on concrete with spectrophotometer and its effect on environment. We prepared samples of varying % of TiO_2 and checked the effect on its strength, and its ability to resist the radiations and compared their results with normal concrete.

Keywords: Titanium Dioxide, Photocatalytic process, Spectrophotometer.

ABICNAN2019100758

UV-Irradiation Induced Synthesis of Reduced Graphene Quantum Dots

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UV irradiated reduced graphene quantum dots (rGQDs) was synthesized by hydrothermal method with glucose as a precursor. The rGQDs used as active electrode material which is coated on stainless steel electrode by using doctor blade method and examined the electrochemical application. The formation of rGQDs was studied by various characterization techniques like chemical interaction by using Fourier transform Infrared spectra (FT-IR), morphology using Field emission scanning electron microscopy (FESEM), Transmission electron microscopy (TEM) and structural phase by X-ray diffraction (XRD). Optical property was studied using UV-visible spectroscopy. The absorption band shows at 241, 365 and 378

nm and Electrochemical behavior was examining by using cyclic voltammetry and linear sweep voltammetry.

Keywords: Reduced Graphene Quantum dots, hydrothermal method, cyclic voltammetry.

ABICNAN2019100760

Catalytic Free Growth of Micro-Honeycomb Vertically Aligned Multiwall Carbon Nanotubes for Energy Harvesting

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The present study introduces a process to grow micro-honeycomb (μHC) vertically aligned multi-walled carbon nanotubes (MWCNT) using thermal chemical vapour deposition. Here, methane is used as a source of carbon and hydrogen is used as a reducing agent. The novelty of process lies in the fact that no catalyst layer is used for the growth of the MWCNT network instead of copper foil. Whereas, the fabricated μHC structure reported in the literature with complex synthesis process always require a catalyst layer. The in-situ cracking of CNTs leads to the formation of μHC CNT network, which is confirmed by Raman spectroscopy. Further scanning electron microscopy analysis shows that the length of developed μHC CNT is ~5 μm. The designed process provided high-yield with a low-cost synthesis of vertically aligned MWCNTs having 3D microarchitectures. Fabricated MWCNT network can be used as an electrode for supercapacitor, active layer in a photovoltaic cell and most of the energy harvesting devices.

Keyword: μ-honeycomb; VACNT; CVD; hexagonal; solar cell

ABICNAN2019100762

Optimization on Heat Transfer Coefficient of MWCNT-TiO_2 Nanofluid inside the Flat Plate Heat Pipe using Response Surface Methodology

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In this, present study, MWCNT-TiO_2 hybrid nanocomposite was synthesized by sonochemical wrapping method method with TiCl as precursor. Then the hybrid nanocomposite dispersed with the ratio of 70:30% by mass in ethylene glycol (EG) as the base fluid. Synthesized nanocomposite were characterized by Ultraviolet spectroscopy (UV), X-ray diffraction (XRD) and scanning electron microscopy (SEM). Thermal conductivity of the hybrid nanofluid was measured using Transient Hot Wire (THW) method. The heat transfer characteristics of the fabricated heat pipe due to the use of MWCNT-TiO_2 nanofluid was investigated. The results showed that MWCNTs were uniformly decorated with anatase nanocrystals. The heat transfer performance of the flat plate heat pipe was investigated using MWCNT-TiO_2 nanofluid at various volume flow rates, concentrations and inlet temperatures by RSM method. The performance is discussed in terms of heat transfer coefficient ratio. The results showed that the

heat transfer coefficient of the nanofluid was far superior than that of the base fluid. From ANOVA results, it is evident that heat transfer coefficient was enhanced with increasing the nanofluid concentration wt.% and also volume flow rate. Conversely, the heat transfer coefficient decreased with increasing the nanofluid inlet temperature.

Keywords: MWCNT, TiO_2, Nanofluid, Flat plate heat pipe, Thermal performance.

ABICNAN2019100768

Bioispired Silver Nanoparticles and their Antiviral (HSV-1) Activity

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Nanotechnology is having prospect to open new boulevard to fight and prevent diseases using atomic scale tailoring of materials. This is indeed a challenging field of research with everlasting future anticipation. As the nano revolution unravel, it is imperative to develop "nano-naturo" links between nanotechnology and green domains of the nature. Herein we demonstrate extracellular synthesis of silver nanoparticles using fruit of the tree *Rhus succedanea*, interestingly the capping molecule provides the antiviral functionality to the newly formed silver nanoparticles against Herpes Simplex Virus -1 (HSV-1). AgNPs were characterized employing high resolution transmission electron microscopic mode, energy dispersive spectroscopy and x-ray diffraction studies. The particles dimentions are in the range between 20-50 nm and crystallite in nature. The active principle of the *Rhus succedanea* seeds kernel extract which synthesizing silver nanoparticles was explored.

Keywords: HSV-1, AgNPs, *Rhus succedanea*

ABICNAN2019100786

Organic Optical Micro-Cavity Resonators for Future Electronic, Optoelectronic and Photonic Devices

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In recent years, organic materials are of increasing demand because of its vital role in electronic, optoelectronic, photonic device development. As these fields are highly concentrated on information and energy, organic thin films/ flexible devices with multifunction are of more interest. Compared to the thin films of organic molecules, miniaturized organic cavities results in multifold enhancement of the optical intensity. Hence, these micro-cavities paves way for the new devices with high stability, flexibility and enhanced light trapping or energy storage. On the other hand, importantly the weaker NLO (two-photon luminescence) signals were enhanced because of cavity effect.

Keywords: Resonator, photonics, luminescence.

ABICNAN2019100788

Zn Doped α-Fe_2O_3: Efficient Material for UV Driven Photocatalysis and Electrical Conductivity

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In recent years, several dyes have been frequently used in many textiles, printing, paper and pharmaceutical industries. The untreated hazardous dyes are discharged into the water leading to enormous environmental problems like perturbation of aquatic life and human health. Therefore, the removal of these dyes from water is of the utmost priority in the scientific community. Several approaches have been made to remove toxic dye molecules from wastewater such as adsorption, coagulation, membrane separation and ion exchange process. However, these methods fails on a larger scale due to their expensive equipments, slow processes and toxic byproducts. Effective and successful method to remove dye is photocatalytic activity in which metal oxide semiconductors are used as a catalyst owing to their large specific surface area, chemically stability and high photocatalytic response. For proposing a photocatalytic system, it is vitally important to establish the stability and activity of the photocatalyst. Out of the existing transition metal oxide semiconductors, iron oxide has drawn technological and scientific interest due to its effect on physical and chemical properties.

ABICNAN2019100792

Optimization of Silicon Photonic Strip Waveguide for Biosensing Applications

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Silicon photonics biosensor detects the changes or alterations that occur in blood cell. The segment of the electric field of the light outside the waveguide referred to as the transient field, target molecular bond to the receptors on the waveguide platform by this absorption of light affects the guided light in the waveguide. The analyte with different Refractive Index (RI) are placed above the waveguide and absorption properties of Blood, Hemoglobin and Albumin were analyzed. This study promotes the efficiency analysis of strip waveguide at the respective wavelength for bio sensing applications

Keywords: Silicon photonics, Biosensors. Mach-zehnder interferometer, blood components.

ProRes Scientific LLP

ProLab Series Glove Box

ProLab series Glove box designed specifically for production and research applications.
ProLab Glove Boxes are use in controlled atmospheres (dry boxes) or for use with hazardous materials.
Protector Controlled Atmosphere Glove Boxes provide a leak-tight environment for work with contamination-sensitive materials.

Glove Box System

Model: ProLab GB II

- **Dimension :** 1240 mm W x 790 mm D x 900 mm H (2 ports, one side)
- **Internal Finish:** 304 stainless steel Brushed Finish
- **External surfaces :** 304 stainless steel Brushed Finish (Powder coating Optional)
- **Wall Thickness :** 2.5 mm (3 mm Optional)
- **Removable front window :** Laminated safety Glass 10mm (Scratch proof and chemical Resistance polycarbonate 9.5mm Optional)
- **Glove Ports :** Delrin (POM) Natural white 220 mm
- **Gloves :** Butyl 0.4mm thickness
- **Box Light :** LED (Fluorescent tube optional)
- **Feedthroughs :** DNKF40 4 No's
- **Electrical Feedthrough :** 1 electrical feedthrough with fuse protected 6 outlet power strip
- **Dust Filter :** HEPA filter class H14 1 inlet /1 outlet
- **Shelves :** 3 height adjustable 304 stainless steel brushed finish
- **Box Stand :** Height adjustable with wheels and locking mechanism

Large Antechamber Stainless Steel

- Cylindrical type 400 mm Ø 600 mm Length
- Inside and outside surface brushed finish
- Stainless steel sliding tray
- Aluminum anodized door 10mm thickness
- Analogue vacuum gauge
- Manual evacuating and refill valve (Automatic refill and evacuating control optional)

Small Antechamber

- Cylindrical type 154 mm Ø 410 mm Length
- Inside and outside surface brushed finish
- Manual evacuating and refill valve

Elite single coloum Gas purification system

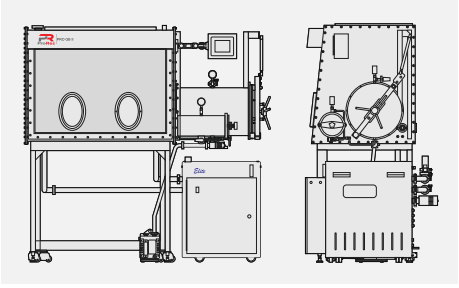
- 7 inch Siemens touch screen HMI, Siemens PLC controller
- Auto-regeneration
- <1ppm O_2 and <1ppm H_2O purity
- O_2 capacity – 41L purification Column
- H_2O capacity – 1450 g purification capacity
- Variable speed circulation blower 110m^3/h
- Automatic purging
- O_2 and H_2O High alarm
- Automatic pressure control +/- 15mbar
- Manual pressure control foot switch (Siemens ip65 water proof foot switch optional)
- 20 m^3/h rotary vane vacuum pump with oil mist filter
- Integrated solid probe oxygen analyzer 0-1000ppm (electrochemical sensor optional)
- Integrated moisture analyzer 0-1000ppm

Applications

- Anhydrous, anaerobic and clean, ultra-clean work environment
- R&D and production of batteries and battery materials (lithium-ion battery, battery, solar cell, the lithium iron phosphate, etc.)
- R&D and manufacturing of HID lamps, metal halide, ceramic metal halide
- Welding: resistance welding, TIG welding, laser welding, plasma welding, brazing
- OLED R&D and production
- R&D and production of medical supplies
- R&D and production of the super capacitor
- Fine chemicals, nuclear industry
- New energy materials, Functional materials R&D and production.

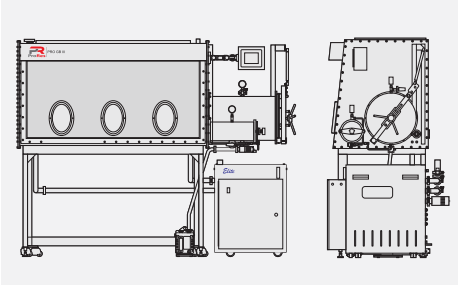
Eco mode operation

ProLab GB II



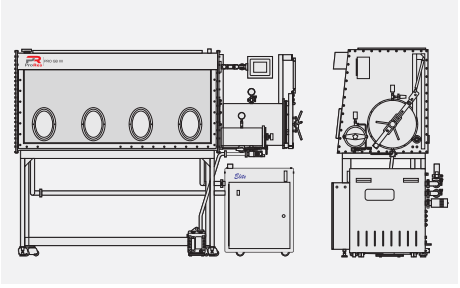
Internal Dimensions:
1240 mm W x 790 mm D x 900 mm H

ProLab GB III



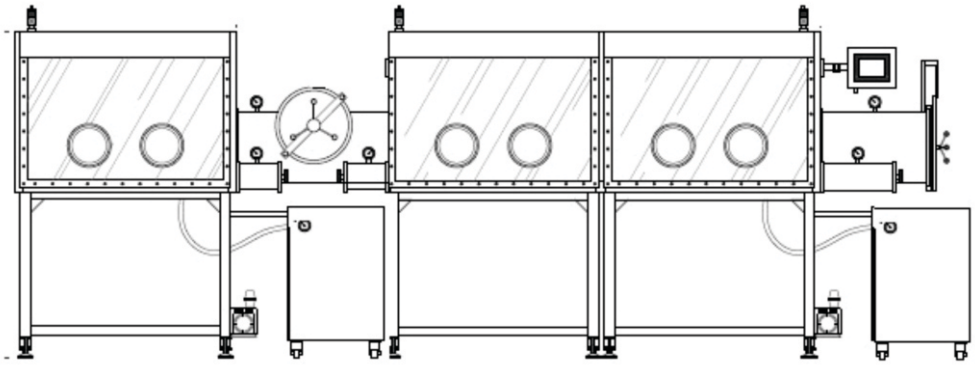
Internal Dimensions:
1550 mm W x 790 mm D x 900 mm H

ProLab GB IIII



Internal Dimensions:
1940 mm W x 790 mm D x 900 mm H

Custom Design Glove Box System



DESIGN OPTIONS

- Double Sided Access
- Left Sided Antechambers
- Through Flow Antechambers
- Laminar Flow
- Circular Glove Ports
- Polycarbonate Window
- Dry Vacuum Pump
- PureSolv MD Integration
- Other Customizations

No. 362/5, Site No.5, Santhosh Layout, Kadabgere Cross, Bangalore - 562130
Email : proresscientific@gmail.com Mobile : +91 9620832434

Padma Paradise, Ground Floor, 2nd Door, Shilpa Avenue Colony, Hafeezpet, Hyderabad, Telangana - 500085
Email : proresscientific@gmail.com Mobile : +91 6305669097

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Thermomechanical Analyzer (TMA)

Thermophysical Property Measurements

Thermal Analysis:

Discovery DSC

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- MDSC® for separation of complex thermal events
- Five-year Cell Warranty

Discovery TGA

- New proprietary Tru-Mass™ Balance
- Exclusive IR Furnace
- Hi-Res™ TGA and Patented Modulated TGA™ (MTGA™)
- Five-year Furnace Warranty

Thermomechanical Analyzer (TMA):

The Thermomechanical Analyzer is a research-grade Analyzer that provides excellent flexibility in test probes, operating modes and available signals.

The main features of the thermomechanical analyzer are as follows:

- Vertical furnace for precise heating rate control
- Wide force range
- Linear variable differential transducer (LVDT)

Thermophysical Property Measurements:

TA Instruments provides the widest selection of instruments for dilatometry and thermal conductivity measurements. Spanning the range of temperature from -150°C to 2800° C, TA Instruments has the right tool for all your inorganic material characterization needs

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Your Partner for Advanced Material Analysis

Developing the advanced materials which gathers a lot of attentions from the Industry requires various analysis.

Research and development of new materials such as ultrafine particles, photo catalyst, hybrid materials, polymers, gels etc. are widely noticed. Not only the production or the fabrication techniques but also the analysis and measurement technology for the evaluation are important for bringing out their characteristics and high functionalities.

HORIBA contributes to the progress of the industry through supporting the research of the advanced materials, by developing the newest analytical instruments and applications.

Particle Characterization

Laser Scattering Particle Size Distribution Analyzer

LA960 Series

The system is known for the dynamic wide measurement range, excellent performance assurance and worldwide user-accepted quality.

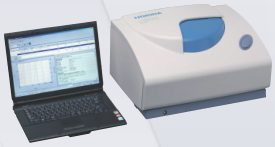
Size range- 0.01µm to 5,000 µm
Measurement duration- 1 minute from dispersion liquid filling to measurement and rinse.
Option- Dry unit, Mini-flow unit, Small volume

Laser Scattering Particle Size Distribution Analyzer

LA-350

The compact LA-350 can achieve high performance, with easy operation and maintenance

Size range- 0.01µm to 1,000 µm
Dimension and Mass - 297×420×375mm (W×D×H) Approx. – 23 Kg



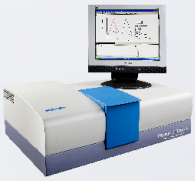
Dynamic Light Scattering Nano Partica Analyzer

SZ100 Series

A single device analyzes three parameters that characterize nanoparticles: Particle size, Zeta Potential and Molecular weight.

Size range- 0.3nm to 10 µm
Zeta Potential - -200 to + 200 mV
Molecular Weight - 1×10^3- 2×10^7 Da

Fluorescence- Spectroscopy



Bench-Top Spectrofluorometer

FluoroMax-4 series

The Fluoromax series of Spectrofluorometer are compact, benchtop units offering the ultimate in sensitivity and flexibility.

FlouroMax-4 : Standard model [200-870nm]
FlouroMax-Plus : Dual detectors (UV-VIS and NIR) for wide range measurement [600-1000nm or 950-1650nm as an NIR option]
Light source : 150W CW Ozone-free Xe arc lamp.
Optional measurements modes : Lifetime options (TCSPC, Phosphorescence

Fluorescence Lifetime Spectrofluorometer

DeltaPRO/DeltaFlex

DeltaPRO/DeltaFlex are the next generation of time-correlated single photon counting (TCSPC) fluorescence lifetime instrumentation.

Minimum Lifetime : 25ps with laser diode source
Shortest measurement time : 1msec
Repetition rates : 10KHz-100MHz with Delta Diode 0.1Hz-2.6KHz with Spectral LED
Time range : 10msec-11 sec
Measurement range : 250 -650nm(Standard) 300-1200nm/400600nm(Options)

Spectrofluorometer

Fluorolog-3

The Flourolog-3 is a modular fluorometer enabling analysis of steady-state and lifetime measurements.

Light source : 450W Ozone-free Xe arc lamp
Spectral range : 200-870nm(Standard)
Other range : On request
Optional measurement modes : Lifetime options (TCSPC, Phosphorescence)

RAMAN

Ultimate Raman Spectroscopy

LabRAM HR Evolution

High spectral and spatial resolution analytical Raman microscope ideally suited to both micro and macro measurements, with advanced confocal imaging capabilities in 2D and 3D.

Spectral range : UV-NIR (200-2,100nm)
Cutoff > 50cm^{-1} (Standard),>5cm^{-1} (Option)
Detectors : Up to three detectors
Options : Laser trapping, Transmission Raman accessory, Particle Finder

GD-OES

Pulsed RF Glow Discharge Optical Emission Spectrometer(GD-OES)

GD-Profiler 2

F ast, simultaneous depth profile analysis of elements , including the gases nitrogen, oxygen, hydrogen and chloride. Perfect for corrosion studies and PVD coating process control.

Measurement range : H-U
Sputtering rate: 1µm/min
Detectors(Standard) : 15ch, Maximum,46ch

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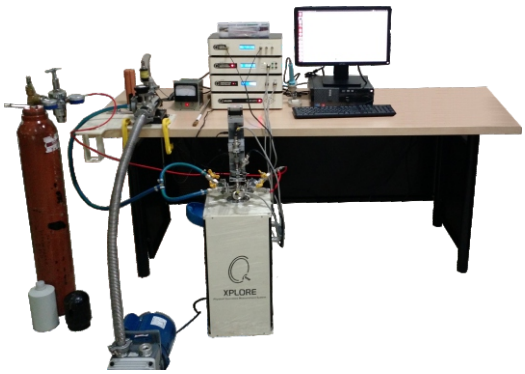
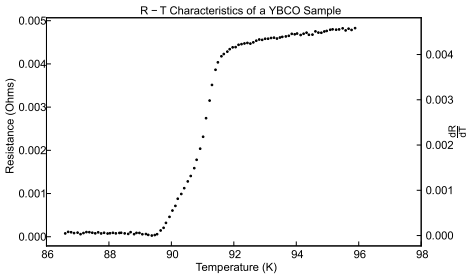
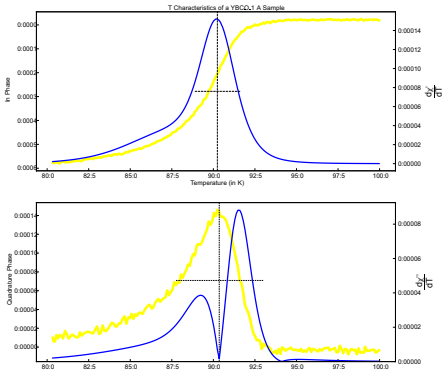
Xplore 1.2 PQMS

Our Xplore 1.2 Physical Quantities Measurement System (PQMS) is a variable temperature material characterization equipment, optimized for the measurement of electrical transport and magnetic properties of materials. This fully automated modular system makes lengthy characterization tests affordable in terms of man-power and easy of operation.







Framework: A liquid nitrogen based cryostat along with a temperature controller offers a temperature range from 80 K to 450 K. A helium gas based flushing system avoids moisture condensation. The frawmwork can also accomodate an air core electro-magnet to produce axial DC magnetic field up to 1000 Oe.

χ-T module: A variable temperature dual-secondary coil susceptometer along with a lock-in amplifier and automatic sample positioner offers measurement of both χ' and χ" as a function of temperature and frequency. The sample is excited with a 5 Oe (max) sinusoidally varying magnetic field in the range of 10 Hz to 10 kHz. System calibration is performed by using known material, like disprosium oxide.

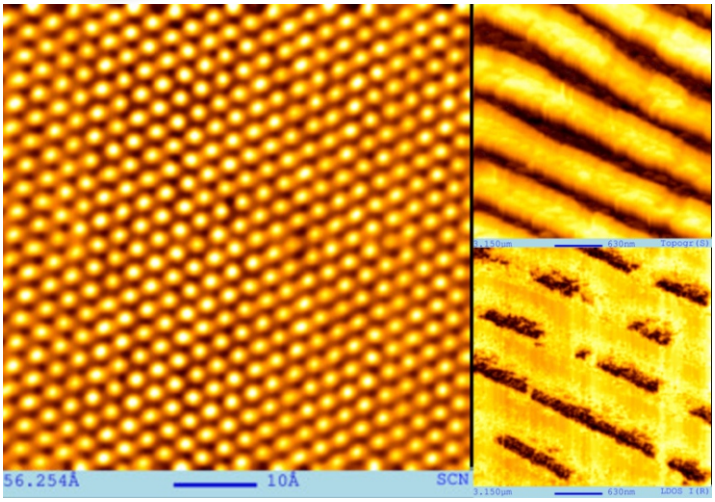
Abbreviations -- I: current, V: voltage, R: electrical resistance, T: temperature, H: magnetic field, χ: magnetic AC susceptibility.

R-T module: Three variable temperature insert and source-meter modules offer a complete range of resistance measurement, viz. a) 10 μΩ to 1 MΩ, b) 1 mΩ to 100 MΩ, and c) 1 MΩ to 100 TΩ. Coupled with the cryostat and electro-magnet framework, it can perform R, I-V and R-H characterization as a function of temperature. Nonlinear I-V characterization is also possible with the help of SmartSwitch feature, which intelligently switches between constant current and voltage source based on the slope of the I-V curve.

nanoREV 7.2 Air Scanning Tunneling Microscope (STM)

nanoREV-7.2 is an ambient air STM which opens out the fascinating nano-world right on to your table-top. It comes with a superb combination of ease-of-use and high-level of sophistication, making it a ready-to-use instrument both for the beginners and the experts in the field of probe microscopy.

Warm thanks to Prof. Anjan Gupta (IIT Kanpur), Dr. Ajit Kumar and Dr. Kundan Singh (IUAC New Delhi).



Atomic resolution images of HOPG (Left). Large scale topography showing the grooves on DVD RW (Top right). Local density of states topography showing the difference in the conductivities indicating the bits written on the DVD (Bottom right).

QRYSTAL-CVD-1100-ATMOS Chemical Vapour Deposition System (CVD)

Our QRYSTAL series CVD system is a fully automated modular platform to perform both chemical and physical vapour deposition using solid, liquid and/or gaseous precursors. A recipe based growth sequence and a controlled growth environment makes lengthy synthesis processes affordable in terms of man-power and easy of use.

Furnace: An independently controlled 1100 Deg.C, 12-zone split-tubular furnace comprising of a quartz tube and Kanthal-A1 heating elements along with N-type thermocouple constitutes the heating framework of the system. An unique design ensures fast tube replacement. Process tube dimensions are OD = 48 mm, ID = 45 mm, and L = 1160 mm.

Vacuum system: A double stage 250 LPM rotary pump connected to the process tube can routinely roduce 0.01 mbar vacuum under normal operation. A clean well-maintained system can achieve 0.001 mbar vacuum.

Mass flow controllers (MFC): 4 channel independent MFCs deliver process gases in the range of 100 sccm or 1000 sccm. Supported gases are nitrogen, argon, helium, oxygen, air, hydrogen, and methane.

Safety interlocks: Safety is a prime concern inside laboratory environment. Hence a number of interlocks has been implemented, e.g. furnace mains are disengaged when lid is opened, furnace over-heat cut-off, tube over-pressure cut-off, low gas pressure warning, and low pressure back-flow protection.

Recipe: The prime feature of the system is automation. User can gain full control over the system using UI based recipes, or Python scripts. Using recipe, user can specify temperature ramp and hold steps, evacuation and flush sequence, gas flow rates, and other system parameters to ensure guaranteed repeatability of process paramters.

About Quazar Tech

Quazar Technologies Pvt. Ltd. (Quazar Tech), New Delhi, is a ten year-old innovative R&D firm in the area of hi-tech instrumentation. It is currently working in several areas of electronics, micro-controllers and electrical engineering, computer science, mechanical engineering and of chemical engineering.

Quazar Tech is led by Dr. Deshdeep Sahdev, who has more than 25 years of research experience in the leading institutes of Europe and America. Quazar Tech routinely attracts engineers from the best universities of India , including the IITs and various NITs.

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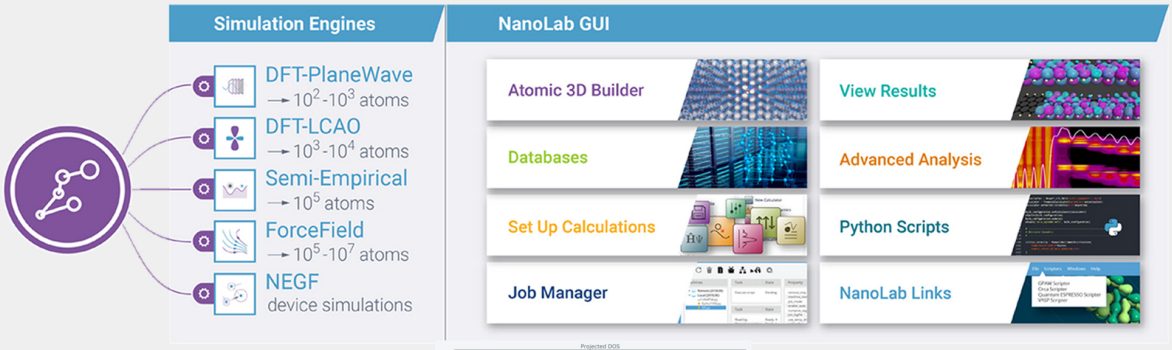
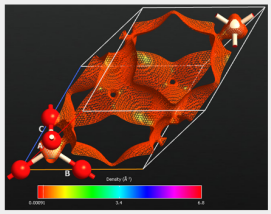
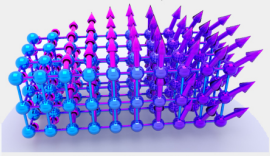
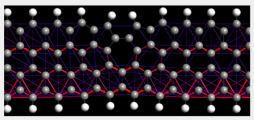
SYNOPSYS®

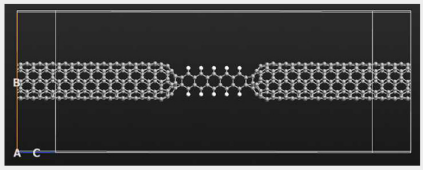
QuantumATK is a complete and fully integrated software suite for atomic-scale modeling of semiconductors, professionally engineered using state-of-the-art scientific and software-engineering methods. It combines the power of a Python scripting engine with the ease-of-use provided by an intuitive graphical user interface. All simulation engines share a common infrastructure for analysis, ion dynamics and parallel performance techniques. The platform consists of the following components:

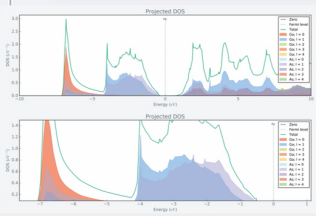


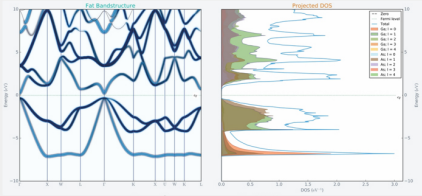

Electron Density of SiO2


Noncollinear Spin


Transmission Pathway


Capped Nanotube device structure


Projected DOS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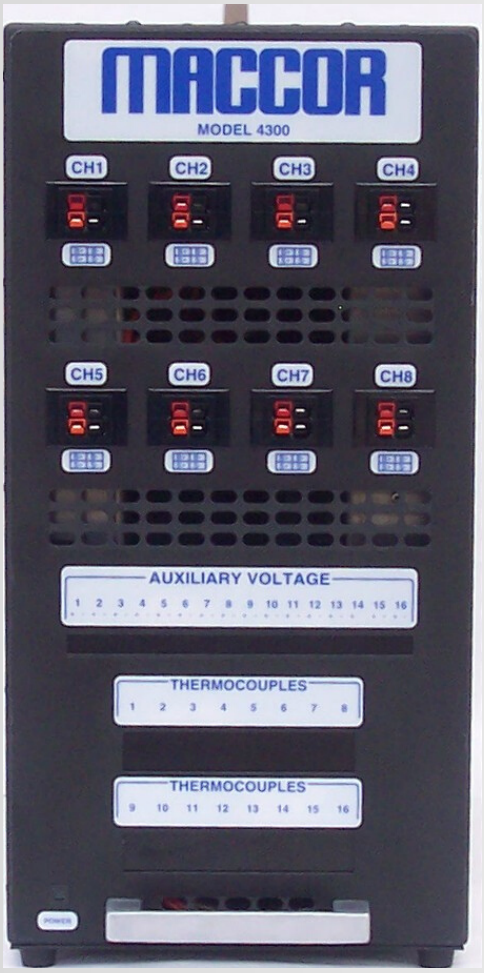

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