



National Institute of Technology Kurukshetra

(Institution of National Importance)

Research & Development Newsletter

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From the Desk of Dean Research and Consultancy

The R & D Newsletter of NIT Kurukshetra aims to disseminate the highlights of the wide spectrum of ongoing research activities in the Institute. During the span of autumn semester of the academic session 2017-18, the Institute has taken long strides towards creation of research facilities, industry connects, and outcomes in the domain of academic research and technological solutions to the problems of the society.

The Research and Development Cell established as a separate entity commences its functioning w.e.f. the financial year 2018-19. The Cell aims to facilitate the smooth and expedited functioning of the submission of the projects and consultancy proposals to the funding agencies, and execution of the sanctioned projects.

"Param Shavak" the supercomputing facility has been put into operation providing the entire research fraternity with huge computing power for their computationally intensive work.

Effective innovation partnership amongst the industries and the academia is equally important for R & D growth. MoUs were entered with financial institutions for joint working on IT infrastructure security and collaboration with digital platforms for the delivery of advanced courses spanning data sciences and business analytics by the industry experts. We are grateful to the students, faculty and staff for their inputs and feedback.

We look forward to hearing from you,

Prof. Brahmjit Singh

Photoinduced release of therapeutic Nitric Oxide from functionalized self-assembled nanovesicles

Sponsor: DBT, Ministry of Science & Technology, GoI



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The aim of this project is to synthesize optimized ruthenium-based nitric oxide (Ru-NO) complexes incorporated in self-assembled/polymerizable nanoscale vesicles that release NO upon irradiation with light. In contrast to simple NO-releasing molecules, self-assembled nanovesicles incorporated molecules might be advantageous due to their monodisperse nature, facile preparation, site specificity, and the degradation products can stay with vesicles surface. We also propose that NO could be released upon induction with visible/NIR light, it is an important requirement for physiological applications.

Development of Highly Sensitive Colorimetric and Fluorescent Moisture Sensors based on Small Molecules, Chemically Modified Paper and Electrospun Nanofibrous Materials

Sponsor: Science and Engineering Research Board

Moisture is an important impurity in organic solvents, pharmaceutical products, foodstuffs and petroleum-based fuels. Therefore, the determination of moisture in chemicals, food products and drug substance are one of the most important analytical measurements. However most of the currently available and traditional methods have the disadvantages of the use of toxic chemicals, long experimental duration, lack of continuous monitoring, slow response time and need of skilled person, these makes them those methods not suitable for all the cases. To overcome these disadvantages in this project we propose to develop a simple easy detection method such as colorimetric and fluorescence sensor (optical) for the detection and determining of trace level of water content in organic solvents and other materials.

Feasibility of Development of Spectrally selective absorbing materials for laser absorbing coatings

Sponsor: DRDO



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In this project to deceive the laser targeting of crucial equipment by enemy, feasibility is to be examined for the identification of suitable materials for laser absorptions in NIR wavelength regions; synthesis of identified materials and their laboratory level evaluation for laser absorbing properties, and optimization of synthesis process for such materials suitable for bulk scale production. In addition to development of IR absorbing materials, for achieving the reduction in reflectance, it is also planned to create a physical gradient or geometric transition absorbers on the IR absorbing coating. Absorption materials are comprehensively employed to deceive the energy seeking devices. These materials have the advantages of longer durability and low cost.

Nanomaterials for stable and high efficiency inorganic-organic perovskite-perovskite tandem solar cells

Sponsor: CSIR



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The direction of research towards application of perovskite material in solar cell has resulted in the development of organic-inorganic mixed/ hybrid perovskite materials for the high efficiency solar cell. Perovskite materials have general formula ABX_3 in which A and B are cations (A is larger than B in size) and X is an anion. The typical structure of perovskite is shown in Figure 1.

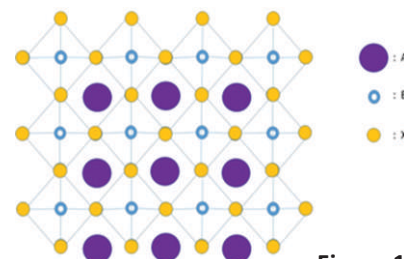


Figure 1

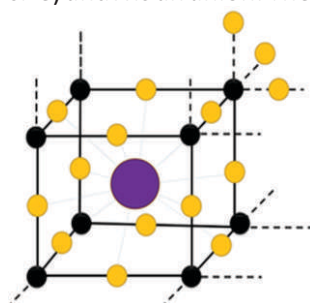


Figure 2

Figure 2. 2D and 3D models of the perovskite structure. The purple molecule is the A element, the black/blue is the B element, and the yellow is the X atom.

Organic-inorganic hybrid perovskite exhibits excellent optical and electronic properties. The small exciton binding energy of these perovskites compared to that of organic semiconductors, as well as the large carrier diffusion length of 100 to 1000 nm and lifetime of ~ 100 ns are beneficial for light harvesting. The organic-inorganic halide

perovskite based solar cells have been the focus of intense research over the past few years. Building tandem structure is an effective strategy to enhance the photovoltaic performance of a solar cell.

Design, Synthesis and Optoelectronic Properties of Squaraine and Croconine based Functional Organic Materials

Sponsor: CSIR



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The purpose of this project is to improve the optoelectronic properties of squaraine and croconine based functional organic materials. These materials are having high interaction with light and show sharp and intense absorption in visible to near infrared region, which had made the significant contribution to the development of electronic devices of modern items. Further, optoelectronic properties of squaraine and croconines are depending on nature of bonding mode in the molecule (C-C / C-N bonding). Keeping in the view of bonding mode of these molecules, the research will be

focused on designing and synthesis of C-N bondings squaraine and croconine dyes. Optoelectronic properties will be studied for the synthesized molecules

ACADEMIC RESEARCH WORK PUBLISHED IN HIGH IMPACT JOURNALS

1. "Vesicles functionalized with CO-releasing molecule (CORM) for light-induced CO delivery", *ACS Appl. Mater. Interfaces*, 2018, 10 (16), pp 14214–14220 (IF: 8.097)
Authors: Rahul Sakla, D. Amilan Jose
2. "Selective Detection of H₂S by Copper Complex Embedded in Vesicles through Metal Indicator Displacement Approach" *ACS Sens.*, 2018, 3 (6), pp 1142–1148. (IF: 5.711)
Authors: Rahul Kaushik, Rahul Sakla, Amrita Ghosh, G.Tamil Selvan, P. Mosae Selvakumar, Amilan Jose
3. "A predictive model for cloud systems", *Future Generation Computer Systems*, Elsevier Vol 81, 2018, pp. 41-52; IF: 4.639
Authors: Jitender Kumar, Ashutosh Kumar Singh
4. "Observation of two-way multichannel interaction in Dy:Eu: Bi₂SiO₅ nanocrystals", *Dyes and Pigments* Elsevier; January 2018, (IF: ~3.77)
Authors: Pushpa Kumari, Y. Dwivedi

HONORS AND AWARDS

(I) INSTITUTION OF ENGINEERS (IEI) YOUNG ENGINEERS AWARD 2018

Dr. Joy Prakash Misra, Assistant Professor Mechanical Engineering Dept., was awarded with Young Engineers Award by Institution of Engineers at its 33rd National Convention of Production Engineers held on May 19, 2018 at Odisha State Center, Bhubaneswar for his extraordinary contribution in the field of Production Engineering

- (ii) Prof. Ashwani Kumar, Electrical Engineering Dept. received prestigious POSOCO Power Awards (Feb. 2018) for guiding the following M. Tech. dissertations adjudged to be the best among Master's Category in top 25 thesis in India:

- (a) Congestion Management using Demand Response Program, Ms. Smriti Singh
- (b) Optimal Scheduling of Energy Storage System, Bhaskarjyoti Das

- (iii) Prof. Ashutosh Kumar Singh, Department of Computer Application received the award of *Best Oral Presenter* in 7th International Conference on Communication and Network Security (ICCNS) held in Tokyo, Japan.



FELLOWSHIPS

(i) German Academic Exchange Service DAAD under the RISE Worldwide Program

Project Title: A Multilingual Semantic Web Portal for the Domain of India Biodiversity

Name of Intern: Ms Anastasiia Kysliak.

Affiliation of Intern: Bachelor student, Georg-August-Universität Göttingen, Germany

(II) THE RAMAN-CHARPAK FELLOWSHIP

Sh. Rahul Kaushik, a Ph.D. scholar with the Department of Chemistry was awarded Raman-Charpak Fellowship from the French Centre for Promotion of Advanced Research (IFCPAR/CEFIPR). He undertook his research work at Paris Diderot University, France for a period of six months.

TECHNOLOGY TRANSFER

SOLAR THERMAL CHULHA FOR DAY AND NIGHT INDOOR COOKING

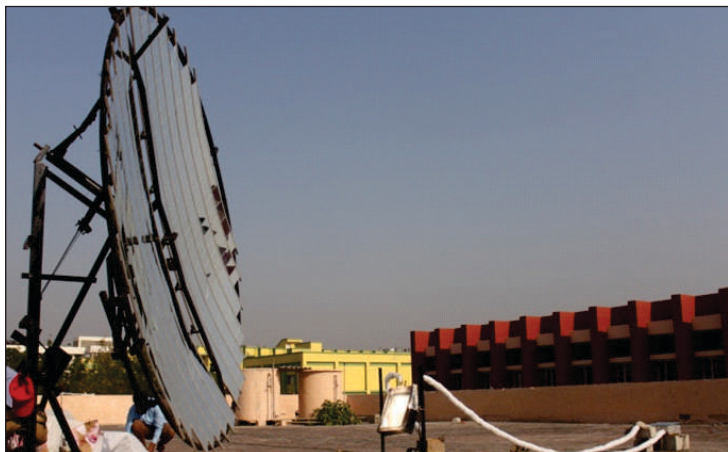


Fig.1 Photograph of Solar Chulha



Fig.2 NIT Kurukshetra being honored at ONGC by the Hon'ble Minister of Petroleum & Natural Gas, Sh. Dharmendra Pradhan Ji

The System uses a rotary gear pump to take cold fluid back to receiver. "Night Chulha" stores heat during day in non-cooking hours and use it during night time. Oil temperature up to 200°C can be achieved in Day Chulha which meets the boiling, steaming and frying requirements of a household. On the other hand, Night Chulha can provide the temperature up to 120°C with heat storage.

WORKSHOPS

INTERNATIONAL WORKSHOP ON SUSTAINABLE ENERGY, POWER AND PROPULSION-2018

"The world has enough for everyone's need, but not enough for everyone's greed.", said, the father of our nation, Mahatma Gandhi once. This quote is a philosophical testimonial to the fact that we can survive with the resources we have rather than stripping the nature off its energy sources which took billions of years to form in its womb. Aimed at moving towards a sustainable future, a novel approach was adopted by the scientific fraternity in the form of an International Workshop on "Sustainable Energy Power and Propulsion." The inaugural ceremony of the 9th iteration of this workshop took place in the Jubilee Hall- National Institute of Technology Kurukshetra on the pleasant late evening of 18th March 2018.



One-Day Workshop on Siemens Centre of Excellence for Industry Relevant Skill Development (March 10, 2018)

In order to bridge the gap between academia and industry, NIT Kurukshetra has taken an initiative to establish a Centre of Excellence equipped with state-of-the-art facilities for imparting industry relevant skill development training to the students of engineering programmes including degree, diploma and vocational courses as well as industry personal particularly from SMEs. The center aims to link education system to industry through Industry Linked Learning Model. The objective of the workshop was to create awareness among the academic institutions/colleges about facilities therein, types and modalities of training programs and contents, and seeking valued inputs from the stakeholders to make the center as the right platform for the students to attain industry relevant skills and hence enhanced employability and entrepreneurship opportunities



CONFERENCES ORGANIZED

The Department of Business Administration organized 30th Annual Conference of Haryana Economic Association on 10.03.2018. Brainstorming sessions were conducted to deliberate on the major issues and challenges of Indian economy. Role of modern agricultural technologies in efficient energy consumption in Haryana and Dairy Farming as a means to eradicate agricultural farm crises were discussed at length and were highly appreciated by all presentees. Prof. Mahesh Siwach, President Haryana Economic Association emphasized on the importance of intellectual discussion and evolving promising solutions to the problems being faced by Indian economy through such platforms. On the occasion of valedictory function, Prof. Rajender Kumar shared his vision of modern economy.



30th Annual Conference of Haryana Economic Association
(10/03/2018)



Molecules & Material Technology (17.02.2018)

One-Day National Conference on Molecules and Material Technology was organized by the Department of Chemistry on 17.02.2018. The inaugural function was graced by Prof. M.N. Maurya, IIT Roorkee as Chief Guest and Prof. (Mrs.) Kiran Singh, Kurukshetra University Kurukshetra, Guest of Honor. Dr. Satish Kumar, Director NIT Kurukshetra in his presidential address stressed on the need of collaboration between academia and industry towards developing economical and sustainable materials.

The 6th National Conference on Nano-Science and Instrumentation Technology was organized by the Department of Physics on 30 March 2018. Dr. R.K. Sinha Director CSIO Chandigarh as the Chief Guest on the occasion of inaugural function highlighted the importance of Nano-Science in the development of efficient photonics. The Guest of Honor, Shri Naresh Kumar Director SASE Chandigarh elaborated on the challenges being faced by Indian Army due to snow avalanche and the technological solutions being developed to overcome those by the SASE Lab. Dr. R.K. Kotnala Scientific Consultant and Former Chief Scientist CSIR-NPL New Delhi showcased his patented hydroelectricity cell which was very well appreciated by one and all.



Nanoscience and Instrumentation Technology (March 29-30, 2018)

MEMORANDUM OF UNDERSTANDING (MoU)

Towards increasing the access of education to the larger section of the society and hence scaling up the GER in the country, NIT Kurukshetra has been committed to and has taken various steps in this direction. In addition, The Institute has commenced to leverage the digital platforms to run online courses particularly in the area of emerging technologies including Big Data, Data Science and Analytics, Artificial Intelligence and Machine Learning. In its endeavor, the Institute has signed a memorandum of understanding with AEON Learning Pvt. Ltd. Bangalore on 01.08.2018. This collaboration has made provision to engage industry experts as resource person for the delivery of the instructions.



To scale up the industry interface and engaging the industry personnel in the teaching and learning process in the institute, a MoU was signed with M/s. Conserve Infotech Private Limited, Jaipur on 10.08.2018. The MoU envisages the expert lectures covering specific topics in modular formats relevant to contemporary industrial needs. This collaboration aims to give exposure of emerging technologies to the students and enhance their employability. The training programme also envisages to contribute to financial sustainability.

Provisioning of the security in financial transactions has become the most important technical challenge for trust building of the people in cashless economy and making (digital India) successful. NIT Kurukshetra has signed a MoU with HDFC Bank, which aims to carry out in-depth study of the security policies and their vulnerabilities implemented on digital platforms being used in banking institutions particularly in HDFC banking network. The students of the Institute will get the opportunity to have experiential learning on real-life data networks and proposing the possible solutions to strengthen the security of financial transactions.



Param Shavak: “The Supercomputer in a Box” Solution for HPC



The High Performance Computing (HPC) facility consists of multi-Tera Flops computing power, NVIDIA accelerator cards, and Deep Learning GPU system. The solution helps to aggregate the computing resources, storage, and graphics capabilities. This facility provides the key resource for high end educational and research purpose. The HPC unit enables the students and faculty to solve large-scale computational simulation, modeling and data intensive problems.



The facility is envisaged to develop high performance computing aware human resource for addressing the complex challenges of the next wave of enabling technologies particularly AI and Machine Learning.



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