



# DEPARTMENT OF CHEMICAL ENGINEERING INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

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CHE, IIT Kanpur



Research Scholars' Day 2018



Prof. Raju Kumar Gupta receiving the Young Scientist award by UP CM Yogi Adityanath



C.V. Seshadri Distinguished Lecture

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## Message from Head Prof. Animangsu Ghatak

Dear Reader,

After the successful publication of the first issue of the newsletter of Department of Chemical Engineering at IIT Kanpur, here we present the 2nd issue. The highlights of this issue are the research focus of three of our faculty colleagues, Dr. Yogesh Joshi, Dr. Raj Pala and Dr. Sri Sivakumar who work in three different areas of Chemical Engineering. The other highlight is a column titled "My Journey to Academia" contributed by Dr. Siddhartha Panda.

In the last six months, nine of our PhD students defended their thesis and we welcomed three new PhD students and four Post Doctoral Fellows. We heartily welcome also Dr. Himanshu Sharma who has joined our department as an Assistant Professor this March. In the first week of November, we enthusiastically celebrated the Research Scholars Day, it was organized by PG students and it was them who presented their work to their colleagues. In the month of December, our faculty members and students organized jointly with colleagues in the Department of Mechanical Engineering, the IUTAM symposium on Dynamics of Complex Fluids and Interfaces here at IIT Kanpur. With the objective of reaching out to potential faculty applicants we hosted a reception at the AIChE meeting, held at Pittsburgh, USA in the month of November. Our faculty colleagues and students continued to be recognized nationally and internationally. We proudly congratulate Professor Ashutosh Sharma, for being selected to receive the State University of New York Honorary Doctorate in Science. We also congratulate Professor V. Shankar for being invited to join the Editorial Board of the Journal of non-Newtonian Fluid Mechanics and Professor Raju K. Gupta for being invited to join as Associate Editor of Solar Energy.

The first issue of our Newsletter was very well received by readers as evident from the appreciations and wishes that I received. These notes have been presented in the "Letter to Editor" section of this issue. I hope this second issue too will give a glimpse of current happenings in the department. In any case, please do write to me your feelings, comments and suggestions; let us remain connected through this Newsletter.

*Animangsu Ghatak*

For any suggestion please write to [head\\_che@iitk.ac.in](mailto:head_che@iitk.ac.in).

## Research Scholars' Day 2018



Research Scholar Day is a yearly one-day event, which showcases the original research of graduate students in the Chemical Engineering department. The purpose of this symposium is to facilitate scientific discussion, foster student-faculty interactions, and provide a platform for students to present their work to a wider audience. An eminent researcher is invited to deliver Professor C. V. Seshadri Memorial Distinguished lecture every year as part of the plenary talks for the Research Scholar Day.

We celebrated our Research Scholar's day on 4th Nov, 2018 during which the CVS lecture was delivered by Professor Rochish Thakkar, from the Department of Chemical Engineering at IIT Bombay. The talk was entitled 'Droplet levitation, Breakup, Emulsification, and Coalescence in Electric Fields', encompassing the Rayleigh breakup process of a charged drop and its model extensions. Prof. Thakkar's group probes a hitherto relatively less-studied area of this field: the inclusion of charge dynamics in the well-known perfect conductor model, which is a challenging problem. One of the fascinating and surprising results of their work is the non-coalescence of two water-in-oil emulsion droplets under strong electric fields. Another intriguing development is that the mode of non-coalescence seems to depend on the nature of the oil and the conductivity of the aqueous droplets.

The second plenary talk of the day was delivered by Prof. Gurunath Ramanathan, from the Department of Chemistry, IIT Kanpur. This special lecture, entitled 'How to Remain an Ethical Academician', discussed the ethics and morality aspects in research and life. Prof. Ramanathan stressed how these aspects may tend to be glossed over, but are nonetheless of supreme importance in the lives of students and professors alike. He also elucidated several points regarding plagiarism, and how to avoid making unintentional mistakes. It was illuminating for these little-discussed issues to be clarified, especially for the benefit of students.

The symposium consisted of a series of sessions of oral talks, and poster presentations by graduate students. Session-I of Research Scholar Day was dedicated to talks on Computational and Theoretical Research. Oral talks were presented by senior PhD students, namely, Anil Mangla, Indresh Choudhary, Manish Maurya, Nandlal Pingua, Pooja Thakur, and Ramkarn Patne. The session was chaired by Shruti Rawat, and Mayank Agarwal. A wide selection of topics were encompassed in these six lectures, ranging from hydrodynamic instabilities in flow, simulation studies in alloys, crystalline order in solids, flue gas separation.

The second session of the symposium focussed on Experimental Research. The presenters of the oral talks in this session were Ankit Tyagi, Ashish Yadav, Bidhan Chandra, Gaurav Rawal, Krishnakant Kundan, Kusumita Dutta. The chairs of the session were Shraddha Mandloi and Shayeri Deb. The presentation included topics on microtubular flow of polymer solutions, nanostructures for super-capacitor applications, hydrogen storage, puncturing of soft brittle solids, the effect of roughness on conductivity.

The award ceremony was held shortly after the poster session. The winners of the oral talks were Bidhan Chandra for the Experimental Research Session, and Ramkarn Patne, for the Theoretical and Computational Session. Pravat Rajbanshi, Khushboo Suman, Anamika Maurya and Rahul Ranjan were the winners of the poster session. A banquet was held in the evening for the department faculty and students, to mark the end of Research Scholar Day.

## New Faculty Joined the Department

**Dr. Himanshu Sharma** joined our department in March, 2019 as an Assistant Professor. Himanshu is a B.Tech., Dual degree in Chemical Engineering from IIT Kharagpur and PhD in Petroleum Engineering from University of Texas at Austin. Before joining IIT Kanpur, Himanshu carried out Post-doctoral research at the Petroleum Engineering Department, UT Austin and then worked at Petronas, Malaysia. He has worked with Tata Steel R&D and R&D Petronas, Malaysia at two different times of his career.

Join me in welcoming Dr. Himanshu Sharma to our department and wishing him a very fulfilling career at our institute.



## Honors and Recognition of our faculty

- **Dr. Rahul Mangal** received the Early Career Research Award grant from Department of Science and Technology, Government of India.
- The web-journal Research Matters highlighted recent work of **Dr. Raju K. Gupta** on mutton-bones aided photocatalysis reactions. The article can be read at the following site:  
<https://researchmatters.in/news/mutton-bones-aid-photocatalysis-chemical-reactions>
- **Dr. Raju Kumar Gupta** was selected for the 'Young Scientist Award' by the Council of Science and Technology, Uttar Pradesh.
- **Dr. Raju Kumar Gupta** has also been invited to join the Editorial Board of Elsevier journal 'Solar Energy' as Associate Editor. He will be looking after Chemical Processes, Photocatalysis and Solar Environmental Applications'.
- **Professor Ashutosh Sharma**, currently serving as Secretary, Department of Science and Technology, Government of India, has been selected to receive the State University of New York Honorary Doctorate in Science.
- **Professor V. Shankar** has been invited to join the Editorial Board of the Journal of non-Newtonian Fluid Mechanics.
- **Professor Jayant K. Singh** and **Professor Nishith Verma** co-authored a book titled "Aqueous Phase Adsorption: Theory, Simulations and Experiments", this book was recently published in UK and US by the CRC press.
- **Professor Jayant K. Singh** has been appointed the Head of newly created Centre for Continuing Education at IIT Kanpur (<http://www.iitk.ac.in/qip/>)
- **Professor Yogesh Joshi** and his student **Khushboo Suman** published an invited cover-page feature article in Langmuir; a schematic art based on the same also appeared as a cover page of the same issue. The article can be read at the following link: <https://doi.org/10.1021/acs.langmuir.8b01830>
- **Professor Animangsu Ghatak** was elected to Fellow of Indian National Academy of Engineering.
- **Professor Animangsu Ghatak** delivered 9th Institute Distinguished Lecture in memory of Prof. C V Seshadri at IIT Bombay. He delivered also the C. N. R. Rao lecture for the year 2019 here at IIT Kanpur.
- **Professor Siddhartha Panda**, Professor in the Department of Chemical Engineering and Coordinator of the National Centre of Flexible Electronics, participated as a panelist in a panel discussion on "Emerging Technologies in Sectors (EV, ESDM, Renewables)" that took place in the Magnetic Maharashtra Convergence Summit in Mumbai on 19th Feb, 2018. Part of the discussion was telecast live on CNBC18 and excerpts were telecast on NDTV 24x7 on 24th and 25th Feb, 2018.

## Honors and Recognition of our Students and Alumni

- **Ms. Khushboo Suman** delivered a seminar on her doctoral work at the Center for Molecular and Engineering Thermodynamics of Department of Chemical and Biomolecular Engineering at University Delaware. Khushboo is working with Professor Yogesh Joshi for her doctoral thesis.
- Our alumnus **Dr. Abhijit Chandra Roy** was selected to receive the INAE Innovative Student Projects Award 2018 for his Phd thesis titled "Soft Aspherical Optical lens". Abhijit graduated from our department in 2018 and is currently an INSPIRE Fellow at Department of Physics, IISc Bangalore. He worked with Professor Animangsu Ghatak for his doctoral research.



- Our alumnus **Dr. Jitendra Sangwai**, Associate Professor (Petroleum Engineering), IIT Madras, has won the National Award for Technology Innovation in Petrochemicals and Downstream Plastics Processing Industry, instituted by the Ministry of Chemical and Fertilizers, Government of India. The award was recently given by Vice President of India, Shri. Venkaiah Naidu at the Centenary Auditorium, University of Madras. Dr. Sangwai graduated with PhD from our department in the year 2007. He had worked with Professor Santosh K.Gupta.
- **Ms. Shweta Sharma** (PhD. student) received a best poster award at the CompFlu 2018 (Complex fluids symposium) held at IIT Roorkee. The title of her poster was: 'Transient start-up dynamics and shear banding in planar Couette flow of a Johnson Segalman fluid'. Ms. Shweta Sharma is jointly supervised by Profs. V Shankar and Yogesh M Joshi.
- Research Paper Presented by our graduate student **Mr. Pallab Kumar Bairagi** in the 2nd International Conference on New Frontiers in Chemical, Energy and Environmental Engineering (INCEEE 2019) has been adjudged as the best paper in the oral presentation under the "Process and Product Development - I" Category held at NIT Warangal from 15th to 16th February 2019.
- M.Tech students of the Department of Chemical Engineering, **Mr. Pankaj Kadam, Mr. Amit Kr. Dubey & Mr. Rahul Jain** were awarded the IChE Ambuja's Young Researcher's Awards for excellent research work in their M.Tech Thesis.

## New Course Introduced

**Advanced Fluid Mechanics**, by Dr. Naveen Tiwari

Fluid mechanics has evolved as a subject over the past several decades and numerous analytical techniques have been developed to solve specific classes of problems. This course aims to build on the fundamentals of fluid mechanics and expose the students to some advanced topics and the relevant mathematical tools. The course will also expose the students to the recent advances in the field.

## Short Term Courses / Symposium organized

- An Introductory Course on "**High-Performance Computing in Science and Engineering**" was co-coordinated by Dr. Jayant Singh and colleagues in different department. (25th February - 1st March, 2019) Scientific Computing has undergone drastic changes in the last decade due to disruptive technologies introduced in high-performance computing. The course will cover the basics of scientific computing and introduce the advances in the HPC.
- A short term course on "**Recent trends in Nanobiotechnology**" was delivered by Dr. Sri Sivakumar (19th – 23rd Nov, 2018).
- A symposium was organized by Dr. V. Shankar on "**Dynamics of Complex Fluids and Interfaces**" (17th – 20th Dec, 2018).



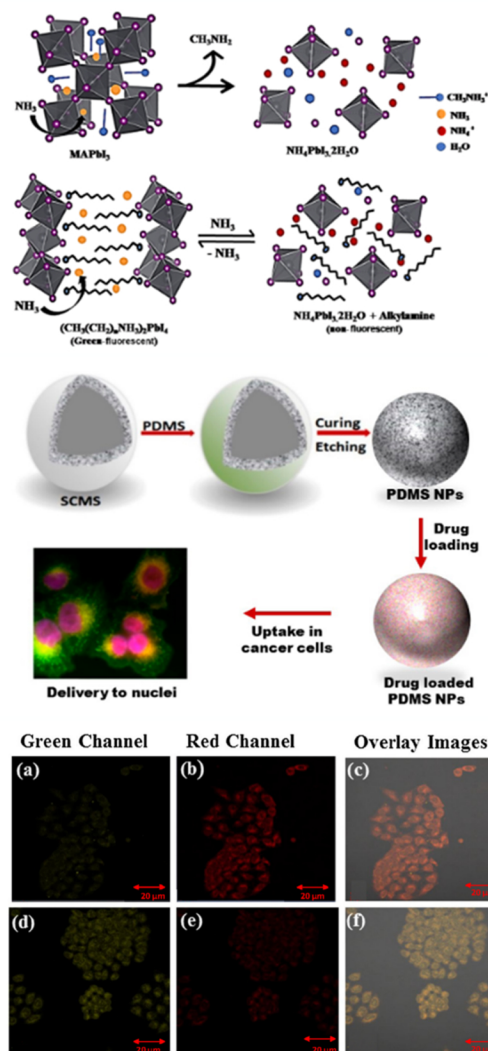
## PROF. SRI SIVAKUMAR, NANOSCIENCE & NANOTECHNOLOGY LABORATORY

Dr. Sri Sivakumar is currently working as professor in the department of chemical engineering, IIT Kanpur. He obtained his B. Sc. (Tech) and M. Sc (Tech) degree from University Institute of Chemical Technology (ICT), Mumbai (formerly called as UDCT)

in 1997 and 2001 respectively. Thereafter he joined Prof. van Veggel's group at University of Twente, as research assistant and later obtained his Ph. D degree from University of Victoria in 2006. Dr. Sivakumar carried out postdoctoral research in Professor Frank Caruso's (Editor, Chemistry of Materials) lab, University of Melbourne. In 2008, he joined the Department of Chemical Engineering at IIT Kanpur as Assistant Professor and later was promoted to the Associate Professor position in 2014. Dr. Sivakumar became full professor in 2019. He has also received several awards, e.g. Class of 1979 Research Fellowship, Prof. CNR Rao best research paper award and senate appreciation for best teaching.

Dr. Sivakumar's research focuses on development of functional nanomaterials for biological and environmental/catalytic applications. He has authored ~75 publications, 4 book chapters, 11 patents and edited one book. He has obtained thirteen grants worth of Rs. 13 crores from government agencies as well as from industry (Chevron, HPCL, Aarti and TCS). Furthermore, he has graduated 12 Ph. D students and currently supervising 14 Ph. D students. Professor Sri Sivakumar works on synthesis of functional nanomaterials for catalysis and biomedical applications. His work on catalysts includes both chemical and electro catalysis. In regard to biomedical research, Siva's work ranges from drug delivery to tissue engineering.

It is well known that nanomaterials can have many different properties, shapes and chemical compositions compared to their bulk counterparts, which means that their fundamental properties—such as quantum phenomena, solubility and surface chemistry can be engineered to make them suitable for specific electronics and biomedical applications. As an example, Siva's group has developed sinter resistant metal nanoparticles loaded hollow zeolites with distinct acidity. These nano-catalysts are used for carrying out cyclohexane oxidation reaction with high conversion and selectivity. Similarly, Siva's group has developed also ultra-small bimetallic nanoclusters (e.g CoMo, NiMo, NiW) which show enhanced catalytic activity for hydrodesulfurization reaction. Another recent development in Siva's lab is a novel method for delivering drugs using PDMS nanoparticles, which Siva has used to release anticancer drug to the nucleus of the cell. Experiments on mice model show that in contrast to conventional methods, this process results in enhanced capability of tumor reduction.





Currently, Siva's group is working on the development of artificial skin model using bioinspired approach. Skin is the largest organ of the human body and acts as the first line of defense against thermal, mechanical, chemical and physical stresses, UV radiation and all the xenobiotic substances. Skin also plays vital role in body-temperature regulation, immunological responses, sensation, synthesis of vitamin D, moisture control and elimination of harmful metabolic substances. However, human skin is prone to damage due to various autoimmune responses, physical and chemical insults, infection, extensive burns etc. and needs cure or replacement once damaged. In this regard, Siva's lab has developed several types of biologically active scaffolds which mimic the native environment of skin including the extracellular matrix (ECM). After seeding different human cell types on top of scaffolds, the cells were found to proliferate in high population with strong adherence to scaffolds. The developed models have been evaluated with different biomarkers and found to have similarity with the native skin.

**Key publications:**

1. G. Mishra, S. Bhattacharyya, V. Bhatia, B. Ateeq, A. Sharma, S. Sivakumar, Direct Intranuclear Anticancer Drug Delivery via Polydimethylsiloxane Nanoparticles: in Vitro and in Vivo Xenograft Studies, ACS Applied Materials & Interfaces, 9, 34625, 2017.
2. R. Singh, D. Kunzru, S. Sivakumar, Monodispersed Ultrasmall NiMo Metal Oxide Nanoclusters as Hydrodesulfurization Catalyst, Applied Catalysis B: Environmental, 185, 163, 2016.
3. D. Bhattacharya, S. Saha, V. P. Shrivastava, R. G. S. Pala, S. Sivakumar, Designing Coupled Quantum Dot with ZnS-CdSe Hybrid Structure for Enhancing Exciton Lifetime, The Journal of Physical Chemistry C, 122, 9198, 2018.



### PROF. RAJ GANESH PALA ELECTROCHEMICAL & REACTION ENGINEERING GROUP

**Dr. Raj Ganesh Pala** leads the Electrochemical-, Catalytic- and Separations-Engineering Laboratory ( "ECCSEL") that is composed of personnel with a blend of experimental and computational skills not only in chemical science and engineering, but also in mechanical and instrumentation believes in an inter-disciplinary approach to engineering research and product development. Such beliefs are buttressed by his motley group of collaborators: Profs. S. Sivakumar@ChE, K. Muralidhar@ME, Jishnu Bhattacharya@ME, Anandh Subramaniam@MSE of IIT-Kanpur and Mr. Joy Bhattacharjee and Mr. Anuj Awasti, from Kanopy Techno Solutions, a start-up focussed on electrochemical instrumentation, of which Raj is a member. The seeds of Raj's inter-disciplinary approach were foisted by his training in Chemical and Electro-Chemical Engineering from the Central Electro Chemical Research Institute (CECRI), Masters in Biophysical Chemistry from the Indian Institute of Science (IISc), PhD in Physical Chemistry from the University of Utah (UU), Post-Doctoral Research in Heterogeneous Catalysis from the University of California at Santa Barbara (UCSB) and "pedagogical physics time-pass" with his friend of 25+years, Prof. V. Shankar, who also happens to be his colleague for 10+ years. Overall, Raj's research has three-prongs: (Simple) model development, (Sustainable) materials development, (Scalable) measurements.

An important theme of Raj's electrochemical research is on Solar Hydrogen as a "renewable reductant", wherein hydrogen is generated from a renewable feed (like water) and renewable energy. The ultimate goal of this effort is to electrochemically sequester the so generated Hydrogen with Carbon dioxide to produce hydrocarbons relevant to the chemical industry [1]. In the near term, it is hoped that hydrogen so produced can not only fulfil decentralized small-scale hydrogen requirements (like hydrogenation of vegetable oils and for fuel cells) but also cater partially to centralized hydrogen demand (like in Ammonia synthesis). Among the many approaches explored, it is felt that co-generation of value added chemicals like Chlorine [2], Potassium Chlorate [3], pure Oxygen [4] along with Hydrogen generating water electrolyzer driven via solar photovoltaic might make the process techno-economics favourable [5]. In addition to these areas, the group also explores material design for Lithium Ion Batteries [6], electrochemical taste sensors, fundamental aspects of electrochemical impedance spectroscopy and electrically actuated droplet motion for short-contact time liquid phase reactors. While increasing overall conversion was the theme of 20th century industrial catalysis, it is felt that enhancing selectivity without compromising conversion will be the focus of catalysis research and development in the 21st century. In this context, Siva and Raj's group are collaborating on metallic core-Zeolite shell catalysts [7] for oxidation of hydrocarbons and biomass related catalytic conversion. A long-standing interest of Raj's group has been to design "non-native" nanostructures [8] and demonstrate their utility in material centric energy conversion and storage devices. Non-native and energetically ground state "native" structures differ in their discrete translational crystal symmetry. Raj's group is also attempting electrochemical modulation of heterogeneous catalytic reactions.



Major parts of India are water starved and in this context, Prof. Muralidhar and Raj's group are working together on solar-driven desalination and waste water treatment [9]. Other relevant processes like membrane distillation, enhancement of water collection efficiency by physically and chemically textured condensing surfaces are being explored.

Raj is part of an IIT-Kanpur incubated start-up "Kanopy Techno Solutions" due to two reasons. First, Raj believes that experimental measurements are central to innovative research and the best method to understand existing techniques and design new measurements is to build our own instruments. Second, Raj hopes that the start-up will facilitate translational research.

Raj's approach to research has been significantly influenced by his research mentors-Prof. Feng Liu (UU), Horia Metiu, Eric McFarland (UCSB) and Jayaraman Chandrasekhar (IISc). He wants to take this opportunity to thank his teachers Drs. S. Madhu and C. A. Basha (CECRI), Prof. K. S. Gandhi (IISc), Prof. Michael Morse (UU), Acharya Dayananda Saraswati (Arsha Vidya Gurukulam), none of whom actively advised him on his research, but showed him how a teacher can have enormous impact in the overall growth of a student.

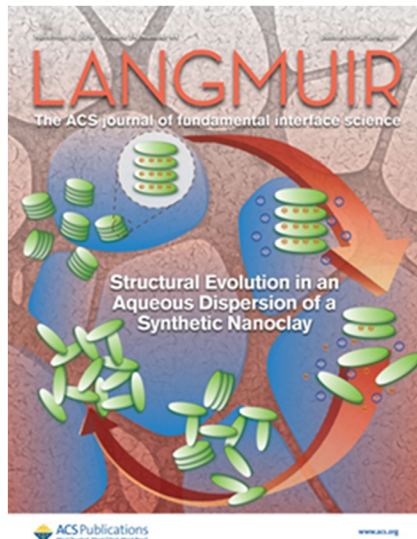
Raj is excited to be a part of ChE@IIT-K, a department that is small enough that its entire faculty are "in focus", but large enough to be only marginally susceptible to the vagaries of a small academic ecosystem. Raj is beholden to its rich academic tradition and contemporary practices that has nurtured his broad teaching and research interests facilitating his desire to "ECCSEL"!

#### Key Publications-

1. "Solar Hydrogen as a "Renewable Reductant": Points and Counterpoints", R. G. S. Pala, CRC Handbook of Thermal Engineering, 1369-1385 (2017)
2. "Increasing chlorine selectivity in seawater electrolysis through weakening of oxygen absorbates at surface in Cu doped RuO<sub>2</sub>", K. Kishor, S. Saha, A. Parashtekar and Raj Ganesh S. Pala, J. Electrochem. Soc., 165 (15), J3276-J3280 (2018)
3. "Dissolution Induced Self-Selective Zn- and Ru-doped TiO<sub>2</sub> Structure for Electrochemical Generation of KClO<sub>3</sub>", S. Saha, K. Kishor and Raj Ganesh S. Pala, Catal. Sci. Technol. 8, 878-886 (2018)
4. "Enhanced water oxidation activity of Co<sub>3</sub>O<sub>4</sub> electrocatalyst on earth abundant metal interlayered hybrid porous carbon support". K. Kishor, S. Saha, S. Sivakumar and R. G. S. Pala, ChemElectroChem, 3, 1899-1907 (2016)
5. "Technoeconomic Analysis of Solar H<sub>2</sub> Production in the Vicinity of Indian Refineries", M. Agrawal, R. Mishra and R. G. S. Pala, 56(3), 258. Indian Chemical Engineer (2014)
6. "Correlating Voltage Profile to Molecular Transformations in Ramsdellite MnO<sub>2</sub> and Its Implication for Polymorph Engineering of Lithium Ion Battery Cathodes", P. K. Gupta, A. Bhandari, Jishnu Bhattacharya and Raj Ganesh S. Pala, J. Phys. Chem. C, 122, 11689-11700 (2018)
7. "Sinter-resistant gold nanoparticles encapsulated by zeolite nanoshell for oxidation of cyclohexane", S. Saxena, R. Singh, R.G. S. Pala and S. Sivakumar, RSC Advances, 6(10), 8015-8020 (2016)
8. "Stabilization and growth of non-native nanocrystals at low and atmospheric pressures", M. Pandey and R. Pala, J. Chem. Phys., 136, 044703 (2012)
9. "Effect of salinity and water depth on the performance of doubly inclined solar still", G. B. Shirsath, Raj Ganesh S Pala, K. Muralidhar, S. Khandekar Desalination and water treatment, 124, 72-87(2018)

## Microstructure and Soft Glassy Dynamics of Aqueous LAPONITE® Dispersion

*K. Suman and Y. M. Joshi, Langmuir 2018, 34 (44), 13079-13103*



**Prof. Yogesh M Joshi** along with his student **Ms. Khushboo Suman** recently published an Invited Feature Article in Langmuir titled "Microstructure and Soft Glassy Dynamics of an Aqueous LAPONITE® Dispersion."

Colloidal particulate systems in a suspension form are ubiquitous in nature and in industry. They have a broad range of applications that depend on the nature of the suspended particles, including their shapes, sizes, charges they possess, and characteristics of the suspending fluid. Owing to surface functionality and extremely high surface area per unit mass, such anisotropic particles spontaneously self-assemble in a liquid media to show a rich array of microstructures. One of the most prominent anisotropic nanoparticle system is clays that has been studied over centuries. Clays have plate-like shape with an aspect ratio in a range of 10 to 1000, and possess dissimilar charges in the aqueous media. Among various types of clays, aqueous dispersion of smectite hectorite clay: LAPONITERD/XLG® has received significant attention over the past few decades owing to its spectacular physical behavior. Synthetic hectorite clay LAPONITE® is composed of disk-shaped nanoparticles that acquire dissimilar charges when suspended in an aqueous media. Owing to its property to spontaneously self-assemble, LAPONITE® is used as a rheology modifier in a variety of commercial water-based products. Particularly, aqueous dispersion of LAPONITE® undergoes liquid - to - solid transition at about 1 volume % concentration. The evolution of the physical properties as dispersion transforms to solid state is reminiscent of physical aging in molecular as well as colloidal glasses. In this feature article Suman and Joshi take an overview of recent advances in understanding soft glassy dynamics and various efforts taken to understand the peculiar rheological behaviors. Furthermore, the continuously developing microstructure that is responsible for eventual formation of soft solid state that supports its own weight against gravity has also been a topic of intense debate and discussion. Particularly extensive experimental and theoretical studies lead to two types of microstructures: an attractive gel or repulsive glass. They carefully examine and critically analyze the literature and propose a state diagram that suggests aqueous LAPONITE® dispersion to be present in an attractive gel state.



	Name of Student	Title of Thesis
1	Ashna Srivastava	Dynamics of multi-component thin liquid film flowing over planar heated substrates
2	Ashtha Gupta	Dipeptide-based Soft Structures: Solution Morphology, Interactions & Applications
3	Asheesh Shukla	Rheology of Soft Pasty Materials
4	Abir Ghosh	A Theoretical Study on Contact Instabilities of a Thin Viscoelastic Film: Influence of Moving Contactor, Surface Curvature, and Patterns
5	Pragya Mishra	Convection in non-Newtonian fluids from bluff bodies: cone, disk and square cylinder
6	Abhi Mukherjee	Role of Surface Modification and Surface Energy Components in Attachment of Sensing Molecules in Strip Based Sensors
7	Lubhani Mishra	Natural and forced convection in non-Newtonian fluids from two circular cylinders confined in a square duct
8	Ashish Yadav	Novel carbon-based nanomaterials in situ dispersed with metal nanoparticles for hydrogen production, storage and environmental remediation applications
9	Parul Katiyar	Behavior of Nanoparticles at Interfaces: Structure, Dynamics and Thermodynamic Properties

# EXTERNAL SEMINAR SPEAKERS (2018-2019)

	Speaker	Affiliation	Title of Talk
1	Dr. Nilesh Patil	Leibniz-Institute for Polymer Research, Germany	Imaging, scattering and structural analysis of Thin films, Polymers Melts & Fibers by X-Rays.
2	Dr. Parag Jain	Lead R&D Engineer/Scientist at Honeywell UOP	Multi-scale Modeling & Optimization for Technology Development in Energy Systems
3	Dr. Himanshu Sharma	Postdoctoral fellow, Department of petroleum engineering, University of Texas at Austin	Low Salinity Wettability Alteration Mechanisms in Carbonates
4	Dr. Shamik Chowdhury	Postdoctoral Research Fellow, Centre for Advanced 2D Materials, National University of Singapore (NUS)	Decarbonizing Energy and the Graphene Revolution
5	Dr. Subhabrata Das	PhD Candidate, Langmuir Center of Colloids and Interfaces, Columbia University, New York	From Colloids at Fluid Interfaces to Hydrodynamics of Foams and Emulsions
6	Prof. Dimitris Vlassopoulos	Department of Materials Science & Technology, University of Crete, Greece	Can soft hairy nanoparticles jam? A comparison between polyelectrolyte microgels and star polymers
7	Dr. Abhishek S. Dhoble	Postdoctoral Researcher on NSF/USDA EAGER in Biological Engineering, University of Illinois, Urbana-Champaign (UIUC), USA	Rapid, High-Throughput Microbiome Characterization in Biochemical and Bioprocess Engineering/Biotechnology
8	Mr. Mayank Agrawal	Doctorate student, Chemical Engg, Georgia Institute of Technology, Atlanta, USA	Advancements in Computational Methods to Study Adsorption in Nanoporous Materials
9	Dr. Ashutosh K. Srivastava	Technology Development Process Engineer, Intel Corporation, Portland	Study of Plasma-Surface Interactions in HBr/Cl <sub>2</sub> /O <sub>2</sub> ICP
10	Dr. Jason Ryan Picardo	Postdoctoral fellow, International Centre for Theoretical Sciences (TIFR) at Bengaluru	Patterned flows: from thin films to turbulence
11	Dr. Sudip Roy	AVP, R&D, Invictus Oncology Pvt. Ltd.	Role of Particle Based Simulations in Industrial application of Soft Materials
12	Dr. Harshwardhan H. Katkar	Postdoctoral Scholar, Dept of Chemistry, University of Chicago	Multiscale modeling and simulations for healthcare applications
13	Dr. R. Ravi	Professor, Chemical Engineering Dept, IIT Madras	Gibbs' Phase Rule and the Azeotrope: A case study in the (ab)use of Differentials





## PROF. SIDDHARTHA PANDA

Joining IIT Kharagpur in 1988 for my undergraduate studies brought with it a mixed feeling of the despondency of leaving the secured confines of “home” and an excitement of a new world – and I transitioned to a new phase in life which had a deep imprint on the things to come. An interest from my high school days to obtain a Ph.D. degree got the nurture by inputs from seniors and the culture of the system. While involving myself in several activities, like several others I too went through the rituals - grade point average, GRE, TOEFL, applying etc., - for the passage to graduate school in the US. The graduate school experience both during my Masters at the University of Cincinnati and the PhD at the University of Houston, opened me to the world of technology development. Working on a

project sponsored by the Dow Chemical Company during my Masters and with a start-up during my Ph.D. exposed me to the different working styles of the different sized companies. Getting the industry input along with the academic input for my thesis works – was an enriching potion for education and training. So close to graduation, I actively sought positions in the industry for focused technology development and did not apply for any academic positions.

After obtaining my Ph.D. degree in 1999, I joined IBM's Semiconductor Research and Development Center, in East Fishkill, New York. The process R&D in a state-of-the-art Lab to meet the stringent industry specifications while working closely with equipment companies, sequentially followed by working with the in-house manufacturing teams for validation and acceptance, and then being involved in the technology transfer to the customers (which is the ultimate validation of the R&D activity) such as Sony Corp. (and others) -- was an amazing professional experience and education. Work was thrilling; but inspite of the immense professional exposure and satisfaction and growth, I knew that this was not my ultimate career destination.

While the decision to move back to India was certain for family reasons, on the professional front the choice was between corporate R&D (which would have ostensibly been a smooth transition being in the same or similar sector) or academia (where being in a different sector I had to almost start all over again). Any transition to a different sector in the professional career after one has set into, comes with it sets of challenges and opportunities. With every career stint in a sector, there is an acquisition of skills for which there is a time for the return of the investment, and there is a conditioning of the mind which guides one's actions and decisions which sets stronger with time. The challenge with a transition is the “what”, “where”, “when”, “how” regarding the utilization of the skills cultivated and experience one brings in, and critically deciding what to keep and what (and when) to unlearn, while acquiring the new skills needed for the new career in the different sector. Then there were the opportunities. I realized that the language I spoke perhaps could not be understood by many but I knew there were at least some who would – that would be good enough. Academia would provide a platform to plan things for the long run, the freedom to be creative – and utilize the best of the old and new skill sets, and carve one's own career path. Cognisant of the challenges but excited about the opportunities, I joined IIT Kanpur in 2006. With any change, one gains some things and one loses some things. Taking into account all aspects important to one in life, I look back with satisfaction with the decision taken. Overall, the system here at IIT Kanpur has been very supportive, and there have been colleagues who have given time and support, helped through the challenging times, and provided the inspiration. At the end, it is all about how one utilizes the opportunities available, being patient and believing in one's self. Life is a marathon race which is not over yet – one needs to keep running and running and running.

- Porous glass paper as support for supercapacitor applications (Dr. Raju Kumar Gupta): Pilkington Technology Management Limited, United Kingdom.
- Development of Ta-doped TiO<sub>2</sub> film over silica coated glass substrate (Dr. Raju Kumar Gupta): Pilkington Technology Management Limited, United Kingdom.
- Experimental and theoretical investigations of complex rheological behaviors in time dependent (aging) soft materials (Dr. Yogesh Joshi): SERB.
- Understanding and prevention of syneresis in gels (Yogesh M Joshi): S C Johnson, US.
- Understanding effect of composition processing and ageing of cleaning compositions on rheology (Dr. Yogesh Joshi) Hindustan Unilever Limited.
- Improving rheological behaviour of agro-products (Yogesh M Joshi) UPL Limited.
- Development of theoretical model for droplet dynamics of anti-corrosion treatment on hot float glass (Dr. Naveen Tiwari) : Saint-Gobain Research India.
- Fundamental understanding of the reaction kinetics of the chemical vapour deposition process (Dr. Naveen Tiwari) : Saint-Gobain Research India.
- Numerical modeling study of float glass manufacturing process and CVD coating (Dr. Naveen Tiwari) : Saint-Gobain Research India.
- Numerical modeling and analysis of the OVD process for optical fiber manufacturing (Dr. Naveen Tiwari, Dr. Goutam Deo and Dr. V. Shankar) : Sterlite Technologies Pvt Ltd.
- Design of painless syringe-needle assembly inspired by mosquito proboscis (Dr. Animangsu Ghatak) : Portescape India Private Limited, India.
- Development of process for making rewritable and re-printable paper material (Dr. Animangsu Ghatak) : SERB.

"... I browsed through the annual newsletter that was sent. A Great start. A very impressive report – great research being done ... Proud to be from the department. Your report brought many memories."

**Prof. Rakesh Agrawal**

"Hearty congratulations on bringing out the first issue of the department newsletter. Please congratulate all those who helped put it together ... Delighted to read all the significant developments by highly capable faculty, students and staff."

**Prof. JP Gupta**

"Hats off for this excellent publication to the department and the team. Very informative and useful touch base with the activities of the department ..."

**Dr. Prabhakar Sethi**

"... Glad to receive this issue to my inbox. Congratulations to the department on all the achievements. I would also be glad to receive future updates too."

**Mr. Akshay Kotha**

"Thanks for the Wonderful Initiative. It helped in connecting back to the institute and probably made me think on how I can contribute to IITK..."

**Mr. Raghvan Jayan**

"It is nice receiving a copy of Newsletter from Chemical Engineering Department. It looks that the young faculty has been very active and productive ... All the best and keep it up with excellent work."

**Prof. Subhash Bhatia**

"Congratulations to the entire Department of Chemical engineering for the first ever Newsletter. The letter is really informative and I am glad to see the various initiatives being taken ..."

**Mr. Pankaj Mathur**

"The newsletter is excellent. Department and your team are doing amazing work."

**Mr. Ketan Bhagat**

"It feels wonderful to receive the first issue of the newsletter of Department of Chemical Engineering at IIT-K. I wish the department the very best for all the outstanding works and research activities."

**Mr. S. J. Jhaveri**

## GIVING TO CHEMIE IITK

As we gear up to implement 25% increase in student strength over next two years, we welcome our well wishers to generously contribute to our department fund. Needless to say, your contributions can help us in creating new infrastructure for both teaching and research, particularly expanding the UG and PG laboratories of the department. It can help us in engaging and supporting more students in research, in keeping our common research facilities in working condition and in attracting also top class faculty members for further enriching our department academically.

For any question, comment and suggestion please write to  
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## LIST OF CHE, IITK FACULTY

- Animangsu Ghatak (HOD)
- Anurag Tripathi
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- Goutam Deo
- Himanshu Sharma
- Indranil S. Dalal
- Jayant Singh
- Naveen Tiwari
- Nishith Verma
- Nitin Kaistha
- Pankaj Apte
- Raghavendra Singh
- Rahul Mangal
- Raj Ganesh Pala
- Raju Gupta
- Sanjeev Garg
- Siddhartha Panda
- Sri Sivakumar
- V. Shankar
- Vishal Agarwal
- Yogesh M. Joshi

## POST-DOCTORAL FELLOWS

- B. Bhuvaneshwari
- Geetanjali Chattopadhyay
- Kartikey Verma
- Neelima Tripathi
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### Designed By

Prerna  
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**DEPARTMENT OF CHEMICAL ENGINEERING**  
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