

## **DEAN'S MESSAGE**



Dear Alumnus:

Warm wishes from your alma mater. I trust that you and your family are in the best of health.

Our GO-IITB campaign is still going on in full swing. I hope that you have had a chance to look at it and have already contributed to the campaign. I thank you in advance for your generosity.

The Institute held the Interim Session of the 61st Convocation Ceremony in February and conferred degrees to 312 students. We were delighted to welcome Dr. Anand Deshpande, Founder, Chairman, and Managing Director, Persistent Systems Limited, as the Chief Guest at the

function. Dr. Sharad Kumar Saraf, the Chairman of the Board of Governors, IIT Bombay, presided over the function while Prof. Subhasis Chaudhuri, Director, IIT Bombay, awarded students with their degrees. My heartiest congratulations to all our graduates and I wish them the very best as they embark on their professional careers into the real world.

We were honoured and privileged to host Professor Serge Haroche, 2012 Nobel Laureate, who delivered a distinguished lecture as part of the workshop on Quantum Science and Technology organised by IRCC – ICONS 2023 on February 17, 2023, at IIT Bombay.

IIT Bombay faculty continued to bring glory to the Institute through their achievements at the national and global levels. Please look into the 'Professor Accolades' section and join me in congratulating them for the laurels they have brought to themselves and the Institute.

Going forward, we have several important events coming up in the upcoming months. These include the Australia and Singapore Alumni Connect Roadshows during the third week of March, the FAN-DAM event which will be held in India this year in end-March and early April, the inauguration of two Centres of Excellence – KCDH and C-MInDS, the Institute Valedictory function in April, and the second Corporate Social Responsibility Enclave in June.

Please look through the March newsletter for many of our regular articles including Faculty Profile, Chair Professorships, Student Success Story, Alumni News, Institute Highlights, Upcoming Events, Faculty Accolades, and more.

Before I sign off for now, I want to thank you all once again for your continued warmth and generosity. I am sure you will continue to support your cherished alma mater in the future, as well. I hope you will come by and visit us on campus soon.

I would like to extend my warm greetings and felicitations/salutations to all of you on International Women's day. Let us celebrate the power, strength, benevolence and completeness of all the incredible women around us. I also wish you and your family a happy, colourful Holi... May your lives be filled with the vibrant colours of joy, love, and friendship... and also, a joyous Gudi Padwa festival!

Sincerely,

Prof. Ravindra D. Gudi, Ph.D., FNAE and FIChE  
Dean – Alumni and Corporate Relations  
Institute AI & ML Chair Professor

## **GIVING**



<https://youtu.be/FbyYQJMzy5w>

One of IIT Bombay's most legendary and beloved professors, Prof. S. P. Sukhatme, in a speech in 1996 said, "The Institute has a tryst with



excellence and it shall keep that tryst." It reflected his heartfelt desires and dreams for the Institute, and 27 years after the event IIT Bombay continues to use his words as its guiding light.

And it is this tryst with excellence that has resulted in IIT Bombay becoming an 'Institute of Eminence.' The Quacquarelli Symonds (QS) world university ranking has placed it consistently amongst the top two institutes of India, and 47 out of the top 50 JEE rank-holders chose IIT Bombay as their preferred institute of education in 2022.

IIT Bombay discerned early on that exceptional students needed exceptional faculty to teach, mentor, and inspire them. And it was imperative to recruit faculty members pursuing trail-blazing research that can impact humanity and mankind, and who can play a transformative role in the lives of the current and future generations of students at the Institute.

Consequently, IIT Bombay, together with the Class of '82 (as its Legacy Project), created the Young Faculty Award (YFA) to attract young academics and postdocs pursuing cutting-edge research, scientists and innovators working in the industry, young faculty members working in foreign universities, and more, to join its prestigious faculty body.

The YFA gives a joining bonus of Rs. 4 lakhs (USD\$ 6,600) over a period of 3 years to every new faculty hire at IIT Bombay. The Institute also provides them with a vibrant and challenging ecosystem that includes setting up their own research labs, developing technological innovations, and contributing to nation-building. This incentivization has led to a significant increase in the acceptance rate of appointment letters at the Institute.

However, the Institute, along with its student population, is growing rapidly and needs to attract and recruit even more young faculty members. For when brilliant minds teach, nurture, and mentor equally brilliant younger students – the cycle of brilliance continues.

Your contributions to this program can help us hire the best and brightest minds from all over the world to the Institute.

**DONATE**

[https://alumni.acr.iitb.ac.in/donation/?cause=current-campaign-greatest-needs&sub\\_cause=go-IITB-annual-fund-raiser](https://alumni.acr.iitb.ac.in/donation/?cause=current-campaign-greatest-needs&sub_cause=go-IITB-annual-fund-raiser)

**IT Hardware**



IIT Bombay is proud of always keeping pace with the changing times of the world. In 2023, the traditional classroom, notebooks, and textbooks have now given way to laptops, tablets, and virtual classrooms. And online digital education – from conducting/attending regular classes to completing coursework to pursuing research – is the new normal.

But for remote learning to be truly successful, students need access to hardware such as computers, cell phones, and tablets, as well as reliable internet connections that would enable them to continue their education online.

Through the IT Hardware Fund, IIT Bombay will ensure that deserving students are provided with computer hardware and network resources that will ensure that they are able to continue their education remotely and keep up-to-date with their studies.

Your generous donation to the 'IT Hardware' initiative will level the playing field and provide equal learning opportunities for all our students as they move on to become leaders, innovators, and entrepreneurs of the future.

### **DONATE**

[https://alumni.acr.iitb.ac.in/donation/?cause=current-campaign-greatest-needs&sub\\_cause=go-IITB-annual-fund-raiser](https://alumni.acr.iitb.ac.in/donation/?cause=current-campaign-greatest-needs&sub_cause=go-IITB-annual-fund-raiser)

## **FACULTY INTERVIEW**



### **Prof. Shamik Sen: Making the Journey from Mechanical Engineering to Biosciences and Bioengineering**

*Prof. Shamik Sen is a Professor in the Biosciences and Bioengineering Department at IIT Bombay. In a freewheeling conversation with the Dean ACR newsletter, Prof. Sen traces his beginnings as a mechanical engineer to now working in bioengineering, tells us why the quality of publishing is more important than quantity, and*

*his dream of developing a product for healing wounds. We are delighted to speak with him for the Knowledge Tree.*

**Thank you for speaking to us, Prof. Sen. Can we begin with you taking us through your academic trajectory?**

After 12th grade, I joined the UG program in Mechanical Engineering at Jadavpur University in Kolkata. After that, I took a year-long break during which I worked briefly in the industry. Between 2000-2002, I was at IIT Kanpur pursuing M. Tech. in the Mechanical Engineering Department. Post IIT Kanpur, I had another brief stint in the industry before signing up for the Ph.D. program at the University of Pennsylvania in the Mechanical Engineering department.

**Why did you go make the transition from Mechanical Engineering to Biotech?**

In the US, science is very interdisciplinary. During my Ph.D., I worked on cell biophysics which looks at the importance of mechanics within the context of biology. Subsequently, I pursued a postdoctoral stint at the California Institute for Quantitative Biosciences at UC Berkeley. While trying to find a position in India after completing my post-doctorate, I realized that my research would be a better fit in the bioengineering department as opposed to traditional engineering. In India, IIT Kanpur was the first among IITs to begin a Biological

Sciences and Bioengineering (BSBE) department. Subsequently, similar departments have started at multiple other IITs including IIT Bombay.

**Did you not think about working in the US?**

I was always clear about returning to India because I wanted to be around my ageing parents. My sense of “Indianness” has also been very strong. Incidentally, I have a twin brother who is settled in the USA.

**So you came back to India in 2010 and joined IIT Bombay?**

Yes, I have been at IIT Bombay since July 2010. I consider myself very fortunate to call this beautiful campus my home.

**So, was working in academia always the plan or did you ever want to work in the industry?**

Actually, I am a third-generation academic in my family. My grandfather was a Professor of Chemistry. My father was a Professor in Applied Mathematics at Calcutta University. My mother taught at the Master’s level in education and philosophy. But I did not force myself into academia; I embraced it spontaneously as part of the natural course of things. My brief stints in the industry were an eye-opener that made me realise that I was an academician at heart.

**Why do you say that?**

I worked briefly at Thermax – a boiler manufacturing company. It was a good experience but I was looking for a more analytical job profile. I then worked briefly in Maruti Udyog, Gurgaon prior to joining IIT Kanpur for my Masters. After graduating from IIT Kanpur, I went on to join a software company called Geometric Software Solutions Limited (GSSL) in Pune. The work environment at GSSL was challenging but also intense and regimented. I prefer more control over my work hours and greater independence to explore new directions. Starting my day at 8 am and ending at 10 pm six days a week was not a life that appealed to me.

**OK. Switching gears a little – can you explain your research in layman’s terms? And how is it relevant to our real life?**

I look at biology through the lens of mechanics or physics. For example, say I am designing a pillow for a child versus an adult. For a new newly born child, the pillow needs to be very soft because it should not cause any stress to the child. But for an adult suffering from arthritis or other related problems, a soft pillow is an absolute no. It needs to be firm and provide support. In technical terms, the stiffness of the environment matters. Stiffness means how compliant, soft, or stiff a product is. This is an example of mechanics at play in our day-to-day life. In the context of a disease, women who suffer from breast cancer can feel something stiff developing in their breasts. The ‘stiffness’ indicates the presence of a growing tumour. This is an example of how mechanics are intimately connected to all our biological processes.

I work in the broad area of Mechanobiology, where we aim to understand biological processes through a slightly different lens. For example, many diabetic patients sustain wounds very easily which do not heal quickly. We are trying to come up with a form of wound dressing that not only prevents infection but also provides the necessary environmental and mechanical support for the tissue to regrow. A lot of research, particularly in the area of tissue engineering, tries to reconstruct wound dressing, where you try to incorporate physical and chemical factors, which can then lead to the faster healing of wounds. My lab is also working on this as one application area.

So these are all practical applications of mechanics.

**Great. Can you now talk to us about your lab?**

My lab is called the Cellular Biophysics Lab where we work in the areas of cancer biology, stem cell biology, and tissue engineering. The common thread that connects them is how the physical surroundings of the cells control their functioning either in a physiological context or in a pathological context.

Using the knowledge gleaned from basic science projects, we try to translate it into prospective applications. For example: in biological research, a lot of small animals like mice or rabbits are used routinely for drug testing, efficacy, etc. Now, in India, animal testing for cosmetic products is banned. So the aim is to come up with physiological in-vitro testing and recreate this kind of complexity outside the body, and then do some drug testing to predict if the drug will work or not. Along similar lines, we are trying to develop a platform

technology for screening anti-metastatic cancer drugs.

As many are aware, Type II diabetes (T2DM) is a chronic metabolic disorder defined by perturbation of blood glucose homeostasis due to the death of a certain type of cell in the pancreatic islet called  $\beta$  cells. A potential therapeutic strategy for combating diabetes is exogenous  $\beta$  cell mass regeneration and transplantation to diabetic patients. We are trying to engineer in vivo mimetic scaffolds for the expansion and transplantation of  $\beta$  cells.

**Given that you've been in IIT now for over a decade, how has the IIT Bombay ecosystem helped you in your research, and in your career?**

There are always some pros and cons. On the plus side, our department is one of the most interdisciplinary departments with traditional biologists, physicists, chemists, medical doctors, as well as mechanical and electrical engineers. It truly is a very diverse population that is also very collaborative and gives rise to many unique ideas that would not have been possible if all of us were doing the exact same thing. As a department, we are one of the most dynamic groups in terms of productivity, publications, and technologies. The same is reflected in our interdisciplinary student population as well.

But biology is extremely resource intensive. IITB's intramural research support is much lower than other research institutes in India like CSIR labs, Biotechnology Institutes, the National Centre for Biological Sciences, and the Tata Institute of Fundamental Research. They receive a lot more institutional support whilst we are entirely reliant on extramural funding. Many times, government funds or grants are delayed. But these challenges are not just specific to IIT Bombay. They're true of most institutes nationally.

**So do you look for support from the corporate world?**

Yes. CSR funds have been a blessing for academicians. But the flip side is that the kind of projects they look to fund are more translational in nature with a clear social impact, which may not be within the scope of what we are doing.

**That's tough. I hope things get better, Prof. Sen. So, you said previously that your department is one of the most successful when it comes to publishing and research. What is your take on the 'publish or perish' syndrome in academia these days?**

There are two aspects to it. One is with publishing. Let's say I've been awarded an extramural grant from the government which comes from our taxpayers' money. These can be for different projects. One can be a translational project, where there is an intention to develop a product. Or it can be a basic science project. For a translational project, the product or process is a tangible outcome of the project. For a basic science project, if you don't publish the work, the knowledge will never reach the masses. Publishing makes sure that you disseminate knowledge and establish your credibility. Also, when you use the common man's money, you have to show something tangible.

Unfortunately, we have now gone to the other extreme where the 'impact factor' of your research has become the key determinant of the quality of your work. That's not the ideal way of judging one's work. Since life is so competitive and fast now, no one has the time to actually read your paper entirely to form an opinion. So the easy way out is to rely on the impact factor. Unfortunately, the scientific community has not yet come up with an alternative metric that is more objective and offers a better assessment of someone's efforts.

But publishing for students proves their credibility. Whatever research they are pursuing is being reviewed by experts in the field, and their hypotheses are being tested with academic rigor. And those are the good aspects of publishing.

**That's wonderful. Okay, a quick change in topic. Can you share with us something about your personal life? What are your hobbies?**

As I have said before, I am not cut out for the rat race. I live a disciplined life and am almost never up after midnight. In a sense, my lifestyle could be perceived as dull. I love playing squash and enjoy watching offbeat movies. I also nurture a passion for Sudoku puzzles.

**Finally, before we sign off, what does the future hold for you, professor?**

I think academia gives us the unique opportunity to keep learning. In our department, given the wide diversity of academic backgrounds, oftentimes we end up teaching the same courses over several years. So, my short-term

goals are to teach two new courses. I would also like to write a textbook in my field. In the area of tissue engineering, I am trying to develop technologies for wound healing applications and in vitro drug testing. My hope is that it gets commercialized or at least licensed to some companies and can be developed and reach the common people.

*What a laudatory goal, Prof. Sen has! Undoubtedly, with his dedication to his academic and research endeavours, Prof. Sen will accomplish what he has set out for himself. We wish him the very best going forward and look forward to him bringing more accolades to the Institute in the future.*

*If you'd like to know more about Prof. Sen's research, click on this link here:*

<https://www.bio.iitb.ac.in/people/faculty/sen-s/>

## **DONOR INSITUTED CHAIR PROFESSORSHIP**



### **Prof. Ankur Kulkarni Appointed the Kelkar Family Chair for Quantitative Finance**

#### **About the Donor:**

Mr. Ram Kelkar, a distinguished alumnus awardee, established the Kelkar Family Chair for Quantitative Finance. The vision of the Chair is to support and augment the research activities in this area. The Chair Professor will initiate new academic programmes, elevate R&D programmes and improve industry interactions in the broad areas of quantitative finance.

#### **About the Appointee:**

Prof. Ankur Kulkarni, Associate Professor, Systems and Control Engineering

Professor Ankur Kulkarni is currently the Kelkar Family Chair for Quantitative Finance at IIT Bombay.

Prof. Kulkarni is an Associate Professor who received his B.Tech. from IIT Bombay in 2006, followed by an M.S. in 2008 and a Ph.D. in 2010, both from the University of Illinois at Urbana-Champaign (UIUC).

His research interests lie in decision-making in distributed, decentralised and strategic

environments, using tools of artificial intelligence, stochastic processes, game theory, mathematical optimization, and information theory. His current focus is on informational issues in decision making such as stealth, security, privacy, elicitation, and signalling. He has published 30 papers in international journals and presented more than 30 papers at international conferences.

Prof. Kulkarni is deeply involved in the industry as well. He was a consultant to the Securities and Exchange Board of India (SEBI) where he was solely responsible for suggesting regulatory interventions for high-frequency algorithmic trading. He presently serves on the IT-Project Advisory Board of SEBI and is responsible for advising SEBI on utilising advanced technologies such as AI/ML and data analytics and guiding data-related policies for internal and public use. He is also an advisor to Tata Consultancy Services (TCS) and is on the technical advisory committee of Maha-IT, a Govt. of Maharashtra enterprise. He was previously a consultant to HDFC Life Insurance Company where he tackled the problem of the design of incentives for sales agents. He is presently advising Kotak Mahindra Bank Limited on anti-money laundering and anomaly detection, and Bank of Baroda on smart cash management.

He has received many awards and accolades over the years. He was an Associate (from 2015–2018) of the Indian Academy of Sciences, Bangalore (an honour reserved for only 100 scientists under the age of 35 across all fields). He has also been an editor for several conferences, is a recipient of the INSPIRE Faculty Award of the Department of Science and Technology, Government of India, 2013, and has received several Best Paper awards and the Excellence in Teaching Award at IIT Bombay. He has also visited several universities overseas.

These include MIT, USA; University of Cambridge, UK; NUS, Singapore; the University of Paris, France; IISc, Bangalore, and KTH, Sweden.

On his dual day jobs as a researcher and a consultant to industry, Prof. Kulkarni explains,

*“I am a systems theorist with an interest in systems with multiple decision-making entities linked by complex information structures. This leads to questions such as how must players act, what must players disclose and what can players learn about the other players, and so on.*

*I do two kinds of work — when I pursue research, I focus mostly on shedding light on these issues using whatever tool suits me best; when I consult and do industry work, I get my hands dirty and solve concrete problems using a combination of wisdom obtained from research and some clever improvisations. The financial system is one where these characteristics are borne out extremely vividly while, subliminally, in my research, I am motivated by problems from the financial domain.*

*My most satisfying academic achievements have been uncovering some insights around strategic play and the role of information asymmetry. I am most proud of some theorems I have to my name that is quite unusual and difficult to anticipate without a unique insight into the problem domain. My research has often focussed on interfaces of disciplines. I have also been able to build bridges across domains that are not commonly spoken of together — e.g., information theory and game theory, control theory, information theory, and so on. In that sense, I can say that I have never stuck to any particular “area,” and pursued questions that I thought were natural, regardless of wanting to identify with any area. This, again, has been very satisfying.”*



## **Prof. Milind Atrey Appointed the INOX Chair Professor in Cryogenics**

### **About the Donor:**

The Inox Group of Companies established the Inox Chair in Cryogenics at IIT Bombay with the mission to promote novel research in the areas of Cryogenics and support the activities of the Chair Professor.

### **About the Appointee:**

Prof. Milind Atrey, Dean, Research and Development

Professor Milind Atrey is currently the INOX Chair Professor in Cryogenics at IIT Bombay.

Prof. Atrey has been the Dean, Research and Development at IIT Bombay since 2019. Before taking charge as Dean, R&D, he was the

Professor in Charge of SINE (Society for Innovation & Entrepreneurship), a business incubator at IIT Bombay, for 6 years.

Prof. Atrey graduated from VNIT, Nagpur, in Mechanical Engineering, and later obtained his

Ph.D. in Cryogenics, from the department of Mechanical Engineering at IIT Bombay in 1991.

After working with the Tata Research Development and Design Centre (TRDDC, Pune) for 2 years, he worked on his post-doctoral research in Germany. He returned to India in 1996 to join the Department of Atomic Energy. He worked at the Raja Ramana Centre for Advanced Technology (RRCAT), Indore, to develop an indigenous Cryogenic system. In 2000, he joined Oxford Instruments, UK, as Principal Engineer, to carry out research related to MRI /NMR systems where he worked on the development of a Cold Probe for Electronics Cooling, 4 K Pulse Tube Cryocooler, MRI / NMR, Superconducting Magnet, and Re-condensing Cryostat for Helium.

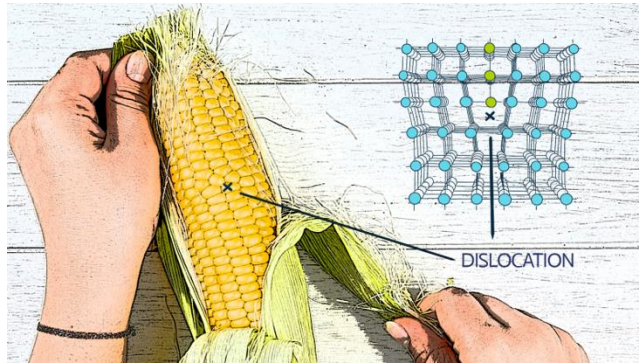
In 2005, Prof. Atrey joined IIT Bombay as an Associate Professor. He became a Professor in 2009, an Institute Chair Professor in 2017, and the Bank of Baroda Chair Professor in Digital Entrepreneurship in 2020.

His current area of research includes Heat Exchangers, Cryocoolers, Cryosurgery, Heat Pipe, and Cooling of Superconducting Devices.

He is a Fellow of the Institute of Mechanical Engineers (FIMechE), a Fellow of the Indian Cryogenics Council (FICC), and the Founding Chair of the Process Industries Division of IMechE, UK, in India. Currently, he is the President of the Indian Cryogenics Council.

Prof. Atrey is the recipient of various awards including the Prof. Sukhatme Award for Excellence in Teaching, the Dr. Patwardhan Technology Development Award, and the Industrial Impact award.

## **RESEARCH SPOTLIGHT OF THE MONTH**



### **Harnessing the Power of Defects to Improve Metallic Alloys**

The following article was originally written for the IIT Bombay website by Mr. Dennis C. Joy: (<https://www.iitb.ac.in/en/research-highlight/harnessing-power-defects-to-improve-metallic-alloys>)

The paper was originally published in **Science Direct:**

<https://www.sciencedirect.com/science/article/abs/pii/S2589152922000448?via%3Dihub>

<https://www.sciencedirect.com/science/article/abs/pii/S1359645422009065?via%3Dihub>

Learning about dislocations and their interactions within an alloy can help precisely engineer its properties.

Two new studies from the Indian Institute of Technology Bombay (IIT Bombay), Mumbai, show the importance of defects in the arrangement of atoms in a crystal, called dislocations, in shaping the physical properties of metallic alloys.

Crystals are often imagined as perfect arrays of atoms, or molecules arranged in rows and columns. Yet, perfect crystals are rarely seen in reality. Most crystal lattices have defects, and one of the types of defects is called dislocation. A dislocation occurs when there is an irregularity or a break in the periodic arrangement of atoms or molecules in a crystal. Essentially, it is a sheet of missing atoms in the regular crystal pattern, causing the planes of the neighbouring atoms to shift in order to fill up the space left by the missing atoms.

Although a defect, the presence of dislocations alters the physical properties of the material – a fact that material scientists have been exploiting to precisely engineer the physical properties of a material, such as its strength, ductility, and electrical conductivity.

In alloys of iron, such as the molybdenum-containing maraging steel, molybdenum atoms are distributed throughout a matrix of iron atoms. When dislocations are present, they act like pipes through which the solute molybdenum atoms can travel much faster as compared to a dislocation-free material, in a process called pipe diffusion. The faster travel of the solute atoms through the dislocations aids in faster ageing of the alloy. Ageing, also called precipitation hardening, is a method of strengthening a material by heating it over long periods until it reaches a desired strength. During the heating, precipitates of the solute atoms (in this case, Fe<sub>2</sub>Mo) are formed throughout the solvent material, thus strengthening the alloy. The more the number of dislocations, the faster the solute atoms could diffuse through the material, reducing the amount of time and energy required to achieve the desired level of ageing.

In their first [study](#), the team from IIT Bombay observed that the shape of the precipitates that formed by pipe diffusion had been altered by faster diffusion of the solute. Precipitates are formed by clumps of solute atoms moving through the material. They were no longer their regular spherical shape but were flattened into a plate-like structure. The team used computer models and simulations to show that as the precipitates grew around dislocation forests, their shape was also altered depending on their interaction with the dislocations. “The



change in the morphology of the precipitates causes deterioration in the alloy's properties, especially its ductility, which is not a good thing. The study gives us clues as to how to control the prior deformation so as to introduce just enough dislocations to gain the benefits of faster ageing while making sure too many flat precipitates are not produced" explains Prof. Nagamani Jaya, who was part of the study.

For their subsequent [study](#), the team wanted to know how a single dislocation interacted with the solutes in the alloy, specifically during phase separation. Phase separation occurs when two phases separate from a single homogenous mixture. For example, when mixing oil and water, the two liquids undergo phase separation to form separate layers of water and oil. The team wanted to study how the presence of a dislocation aided or affected phase separation in metallic alloys. They once again built a computer model to represent a dislocation within a metallic alloy and ran the simulations.

Phase separation usually happens in two ways – nucleation and growth and spinodal decomposition. Nucleation occurs when a small amount of solute atoms of the alloy accumulates at one point within the mixture. Once this accumulating mass reaches a critical size, it starts to grow. For example: considering Fe<sub>2</sub>Mo again, molybdenum atoms will accumulate and grow from a nucleation point within the iron matrix, eventually separating the two. Dislocation networks usually provide a favourable site for the material to start the accumulation and thus start the nucleation and growth process. Spinodal decomposition, on the other hand, happens spontaneously where, at particular compositions, the two components of the alloy phase separate, akin to water and oil separating spontaneously into two distinct layers. Although both are well-known phenomena, it was thought that the two processes never occurred simultaneously in the same material.

In their study, the team from IIT Bombay found that both nucleation and growth and spinodal decomposition could happen at the same time within the material. While a single dislocation aided spinodal decomposition, when there were two intersecting dislocations, it also helped nucleation and growth. "We observed that beyond a certain level of composition (percentages of the two metals in the alloy), spinodal decomposition can happen along the dislocation line. But when we consider a dislocation network instead of a single dislocation, at the junction where two dislocations intersect, nucleation also happens. This is the first time in literature, to the best of our knowledge, that both spinodal and nucleation are shown to occur at the same time," says Arjun Varma R., an author of the study. The team used non-dimensionalized parameters (variables or parameters that are independent of any particular material) for their simulations, which meant the same model could be used to study different metallic alloys.

"When we first saw spinodal and nucleation happening simultaneously, I thought there must be something wrong with our model since we are not trained to think about alloys like this. It took me some time to accept that this was, in fact, true," exclaims Prof. M.P Gururajan, who was part of both studies. Their models were further validated by comparing atom probe results (a type of microscopy for studying atomic structures) from literature in Iron-Manganese alloy, which showed evidence of spinodal happening at the dislocations, In addition to this, they have also predicted, using this model, the range of compositions at which there is a possibility of spinodal decomposition along dislocations, for different alloys.

Both studies show us how dislocations play an important role in determining the physical properties of alloys. It allows us to precisely engineer the dislocations to benefit from it while taming its drawbacks. Apart from applications, the studies also give us an insight into the fundamental science of the behaviour of dislocations and their interactions with the atoms of metallic alloys.

Moreover, apart from the lessons in metallurgy, the studies also encouraged the in-house development of code and computer models, which can be used to study other metallic systems and alloys. "Phase field modelling is one of the benchmark problems for high-speed computing. It also takes a long time to run, depending on the type of supercomputer used. Having built the models and written the code ourselves, our group now has the expertise to further improve the understanding of these materials. These skills developed during these studies are one of the most important aspects for us," remarks Prof. Gururajan.

## **STUDENT SUCCESS STORIES**



## **IIT Bombay's Team Nimbus: Finding Solutions to Energy Poverty**

*Team Nimbus from IIT Bombay placed first and won a cash prize of \$10,000 in the prestigious International Switch Energy Case Competition 2022. The competition was organized by Switch Energy Alliance, a Texas-based non-profit organisation, with support from Sempra and the Hildebrand Department of Petroleum and Geosystems Engineering at The University of Texas at Austin*

*(PGE).*

*IIT Bombay's team comprising Mr. Shivam Kumar, Ms. Roopmati Meena, Ms. Srushti Bhamare, and Ms. Shruti Prajapati, worked on energy poverty issues in Ghana and won the finale where the top 5 teams presented their projects to a live audience and a 3-member jury.*

*We are delighted to speak to the team for the Dean ACR Newsletter.*

**Hi guys, first of all, CONGRATULATIONS! What an incredible accomplishment. I bet you guys are very proud of yourselves, as you should be. Since you worked as a team – we will pose these questions to the team as a whole. Let's start by you telling us your name and your academic background first.**

Our team consists of 4 members from the Department of Energy Science & Engineering. Mr. Shivam Kumar and Ms. Roopmati Meena are pursuing their final year of Ph.D., and their field of research is solar technology. Ms. Srushti Bhamare is a pre-final year DDP student and Ms. Shruti Prajapati is a 3rd year DDP student. The team members are climate and green energy enthusiasts and have won several global accolades in the past. Shivam & Roopmati won the 1st prize in the Indo-German Student Partnership competition 2022 for presenting a sustainable action plan for India and Germany's agricultural and energy sectors. Srushti was part of the team that won US\$ 250,000 in the Elon Musk Foundation's Carbon Removal Competition. Shruti is also the Deputy Project Engineer (Mechanical) at Team Shunya.

**Congratulations once again on the amazing win in International Switch Energy Case Competition 2022! How does it feel to have won this competition? Tell us a bit more about the competition.**

We're proud, happy, overwhelmed, and delighted! All of these adjectives still fall short when trying to describe this win of ours.

The Case Competition is annually organized by Switch Energy Alliance, an Austin, Texas, non-profit organization. The competition challenges university students to think critically about how the world can transition to a sustainable and equitable energy future.

Around 141 teams from 15 countries participated in the competition and were tasked with developing a 30-year plan for improving energy access and reliability in one of these 3 countries: Colombia, Ghana, and Myanmar. Our team worked on energy poverty issues in Ghana and won the finals where the top 5 teams presented their projects to a live audience and a 3-member jury. Our team was also awarded US\$ 10,000 and an internship opportunity at the Switch Energy Alliance, Texas.



### **What does energy poverty mean and what impact does it have on the environment/world?**

Energy poverty is one of the greatest challenges of our time. Energy and poverty are directly related, and statistics suggest that countries with a lack of energy access perform poorly on indicators such as child mortality, literacy, malnutrition, etc. Suffice it to say that life without energy is poverty. At this moment in time, there is a lack of education and awareness about energy poverty amongst the general public, and Switch Energy Alliance wants to bridge this gap through this competition.

However, given the rise in carbon emissions throughout the globe, and its impact on global warming, one must also look towards achieving energy access which can be accomplished through green technology. For the competition, our team worked on solutions ensuring cost-effective energy access for the local masses, as well as using green technology routes as much as possible.

### **Can you elaborate more on your project?**

Our team was entrusted with devising a detailed 30-year roadmap to propose energy poverty solutions in Ghana using sustainable practices through maximizing the utilization of local resources. We defined “Energy Poverty” through 6 key parameters to identify the underlying issues in Ghana namely accessibility, reliability, affordability, safety, quality, and environmentally benign. Based on these parameters, we identified a lack of clean cooking fuel and a lack of electricity as major issues concerning Ghana.

Next, we identified locally available renewable resources in Ghana that can be utilised to provide clean solutions to the maximum number of people within their budget constraints. Biogas as cooking fuel and solar PV with battery storage as electricity sources were selected based on the availability of raw materials in the region.

We proposed a detailed timeline of planning, installing, and implementing our solutions with year-wise capacity additions, identification of sources of funding (both national and international), monitoring/regulating agencies, as well as using the revenue to add more generation capacity systematically.

With our proposed methodology, we can provide access to clean cooking fuel to over 95% of the population and integrate 75% of renewables in their electricity mix by 2050. The budget constraint of \$900 million that would be utilised over a span of 30 years was a major challenge in designing our solutions. In addition, we proposed to utilise ‘carbon credits’ as an additional source of revenue to Ghana which can be utilised to enhance the Human Development Index-related aspects of Ghanaians.

### **What did you learn from this competition that you will implement in all your future endeavours?**

Working with a diverse team has been one of the best learning experiences that we will be taking forward with us. The problem statement in this competition required us to undertake detailed planning and propose an implementation roadmap along with budget constraints. Summarizing all these aspects in a 10-minute video presentation in a crisp yet elaborate manner was a challenge and a good learning experience as well.

### **How do you feel this project can be applied here in rural parts of India the way you have worked towards Ghana's energy poverty issues?**

Though the severity/intensity varies, India is still in a substantially better state than Ghana. However, our proposed solutions can be adopted/implemented in India as well.

### **What would you like to say to the alumni who will read this interview? How can they help?**

Our vast and diverse network of alumni has a tremendous pool of knowledge/experience to solve real-world problems. The students participating in competitions like SEA can benefit from the expertise of alumni in technical, financial, and policy-making. It will help students come up with novel and creative solutions.

### **What's next for all of you?**

All our team members are super excited to join and contribute to the energy sector through industry and academia. Shivam will be soon starting as Energy Analyst in a US-based energy consultancy firm, whereas Roopmati is aiming for a postdoctoral research position in the solar PV recycling sector. Srushti has previously done an internship in the ESG and carbon markets and is now aiming for an internship in the batteries market. Our youngest team member, Shruti, is already leading one of the most talked about green projects of IIT Bombay, i.e., Team Shunya, as the Deputy Project Engineer (Mechanical), and, she will be joining the prestigious Mitacs Research Internship during the summer of 2023.

*What an extraordinary accomplishment by these young and dynamic students from IIT Bombay. Undoubtedly, each member of Team Nimbus will go on to accomplish much more in the energy sector and bring accolades to the Institute. We wish them the very best!*

## **ALUMNI NEWS**



### **Scholarship set up by IIT Bombay alumnus to support one student per year for 25 years!**

IIT Bombay alumnus, Mr. Alok Maskara (B.Tech., Chemical Engineering, 1992) has set up a 'Diamond Level Scholarship' which will support the tuition, hostel, and mess fees for one student per year over a period of 25 years.

The scholarship will be named the "Annapurna and Hare Narain Maskara Scholarship" in honour of Mr. Maskara's parents. It will add to IITB alumni's rich legacy of supporting student scholarships at the Institute.

Honouring his generosity, IIT Bombay has named Mr. Maskara as a "Leadership Circle Donor" as part of a special 'Donor Wall' featured on the #DEANACR website.

Click this link here <https://lnkd.in/dBSNJD4u> to have a look.

Providing an equitable launchpad for success to meritorious students is one of IIT Bombay's key priorities. The Institute is grateful to Mr. Maskara for his contribution which will help provide wings to the dreams of India's deserving youth.

## **INSTITUTE HIGHLIGHTS**



### **2012 Nobel Laureate, Professor Serge Haroche, Delivers the Institute Distinguished Lecture**

Professor Serge Haroche, 2012 Nobel Laureate, delivered a distinguished lecture as part of the workshop on Quantum Science and Technology organised by IRCC – ICONS 2023 on February 17, 2023, at IIT Bombay.

Prof. Haroche discussed the groundbreaking research he has done over the years employing Rydberg atoms in the realm of cavity

quantum electrodynamics. He also spoke about the potential quantum simulation and information processing experiments that may be performed with this setup.



## IIT Bombay Holds Interim Session of 61st Convocation Ceremony

IIT Bombay awarded degrees to 312 students at the interim session of its 61st Convocation held at the Institute’s Convocation Hall. The degrees were conferred upon students who have completed all their academic requirements from August 2022 to January 2023 and requested for their degrees to be awarded earlier than the 61st Convocation ceremony in April.

Dr. Anand Deshpande, Founder, Chairman, and Managing Director, Persistent Systems Limited, was the Chief Guest at the occasion. The function was presided by the Chairman of the Board of Governors, IIT Bombay, Dr. Sharad Kumar Saraf, while Prof. Subhasis Chaudhuri, Director, IIT Bombay, awarded students with their degrees.

In his speech, Dr. Deshpande exhorted the graduates into becoming job creators in the future. He said, “I would like to share four specific ideas that could help you thrive in a fast-evolving world viz. dream big, focus on the power of compounding, make friends and learn to network, and be persistent.”

Dr. Sharad Kumar Saraf, in his address, said, “The experience of your stay at IIT Bombay forms the foundation of your future career. I urge you to make use of the support provided by ‘IIT Bombay Research Park’ and the ‘Society for Innovation and Entrepreneurship (SINE)’ in building a start-up.”

Congratulating the graduating students and their families, Prof. Chaudhuri said, “You will all soon occupy leadership roles in whatever profession you select in your career, but never forget to give back to the people of our country so that together we all can make an impact on the lives of common men.”

Ms. Savitri Gupta, a differently-abled female student of the Department of Humanities and Social Science, received a thunderous applause whilst receiving her Ph.D. degree from the dignitaries.

The ceremony was attended by students, their friends and families, and faculty members of the Institute.



## The National Centre of Excellence in Carbon Capture and Utilization Inaugurated on Campus

The DST-sponsored National Centre of Excellence in Carbon Capture and Utilization was formally inaugurated by Dr. V. K. Saraswat, Hon’ble Member, NITI Aayog on February 11, 2023, at IIT Bombay. Prof. Subhasis Chaudhuri, Director, IIT Bombay, and other dignitaries from academia, government, and industry attended the inauguration.

IIT Bombay Professors Earn Accolades	
<b>1. Prof. Ruchi Anand</b> Department of Chemistry Prof. Anand has been awarded the Faculty Award of Career Development and Innovation by the Council of Educational Research and Training (CER) awarded a silver chair (2022).	<b>2. Prof. Dipendra Prasad</b> Department of Metallurgical Engineering Prof. Prasad has been appointed as the Chief of the National Centre for High Temperature Metals by the Department of Atomic Energy (DAE), Govt. of India.
<b>3. Prof. Samir K. Majhi</b> Department of Electronics and Communication Engineering Prof. Majhi has been awarded the research faculty award by the Council of Educational Research and Training (CER) awarded a silver chair (2022).	<b>4. Prof. Deepankar Chaudhary</b> Department of Civil Engineering Prof. Chaudhary has been elected as the Chair of the newly created post-graduate program in Sustainable Infrastructure at IIT Bombay.
<b>5. Prof. Bhaskaran Maniatharan</b> Department of Electrical Engineering Prof. Maniatharan has received the Faculty Award of Career Development and Innovation by the Council of Educational Research and Training (CER) awarded a silver chair (2022).	<b>6. Prof. Ujjai A. Tiyak</b> Department of Physics Prof. Tiyak's work on understanding quantum superposition in its electron-gravity has been published in the journal Physical Review Letters.

## IIT Bombay Professors Earn Accolades



## **IIT Bombay Celebrates Matribhasha Diwas (International Mother Language Day)**

IIT Bombay celebrated Matribhasha Diwas (International Mother Language Day) on February 21, 2023, to promote the use of the mother tongue at the Institute. Various groups presented cultural programmes in different Indian languages, even as faculty members, students, and IITB staff attended and enjoyed the event.



## **IIT Bombay and MUHS sign MoU to Promote Mutual Interaction**

In a one-of-a-kind collaboration, IIT Bombay and the Maharashtra University of Health Sciences (MUHS) signed a Memorandum of Understanding (MoU) towards promoting interaction between the technology institute and the health sciences university. The MoU enables both institutions to share resources for academics and R&D in diverse areas of mutual interest.



Prof. Subhasis Chaudhuri, Director of IIT Bombay, and Lt. Gen. Dr. Madhuri Kanitkar, Vice Chancellor – MUHS, signed the MoU. Other dignitaries who graced the occasion included Dr. Milind Nikumbh, Pro-Vice

Chancellor – MUHS, Prof. Milind Atrey, Dean (R&D), Prof. Ganesh Ramakrishnan, Professor-in-Charge, Koita Centre for Digital Health, Prof. Samir Maji, Professor-in-Charge, Sunita Sanghi Centre for Ageing and Neurodegenerative Diseases, Dr. Rajendra Shivaji Bangal, Registrar, MUHS, Ms. Surabhi Goel, COO, Koita Foundation, and several others.

Speaking on the occasion, Prof. Chaudhuri encouraged the exchange of faculty and students between the two institutes, while Dr. Kanitkar observed that out-of-the-box thinking was the need of the hour and that the MoU was a symbol of such an innovative approach.

## **UPCOMING EVENTS**



### **Alumni Connect - Australia Roadshow**

A team from the Dean ACR office and the DRF office will travel to Australia for an alumni roadshow-cum-reunion. The team will meet IITB alumni in Sydney and Melbourne. It is a chance for the Institute and its alumni to reconnect, reminisce, and revel in the company of old friends and learn about the exciting new developments at the Institute.

Date: March 11-16, 2023

Time: NA

Venue: NA



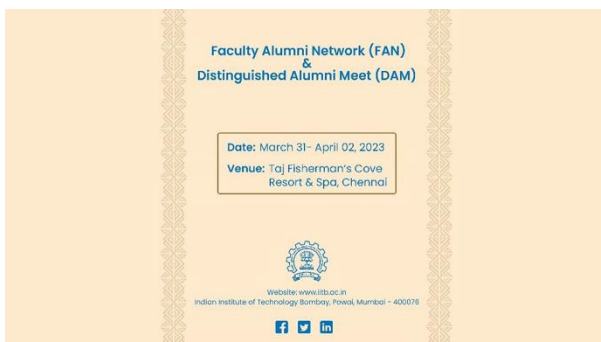
## Alumni Connect - Singapore Roadshow

After the Australia trip, the team will travel to Singapore and meet with IITB alumni settled in Garden City.

Date: March 18-19, 2023

Time: NA

Venue: NA



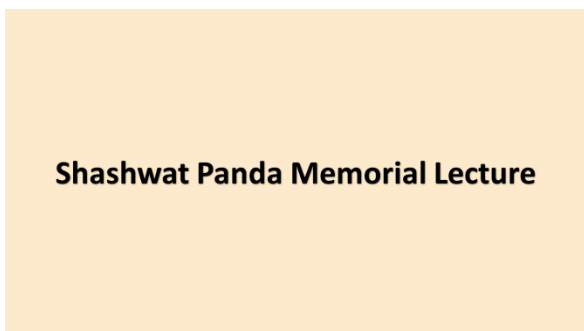
## FAN – DAM

The Faculty Alumni Network (FAN) and the Distinguished Alumni Meet (DAM) will bring together inspiring individuals pursuing cutting-edge research in emerging areas of technology. They will deliberate on emerging areas of research, nucleate collaborative programs for impact, create opportunities, and explore innovative ways to take IIT Bombay to greater heights.

Date: March 31- April 02, 2023

Time: NA

Venue: Taj Fisherman's Cove Resort & Spa, Chennai



## Shashwat Panda Memorial Lecture

IIT Bombay alumnus, Mr. Ram Kelkar, will deliver the Shashwat Panda Memorial Lecture in March 2023 titled, "A career is a journey – not a destination: Vignettes of IITian career paths."

Mr. Kelkar will talk about the skills that matter in the long term and draw parallels to the many unique and impactful career paths blazed by various IIT Bombay alumni. He will also share learnings from his own

career experience in moving from Silicon Valley to Wall Street that was built on the skills and knowledge he gained at IIT Bombay.

Date: March 30, 2023

Time: TBA

Venue: IITB Campus

## HEARTFELT CONDOLENCES



IIT Bombay is heartbroken to announce the tragic loss of one of our very own – young, first-year, B.Tech. student, Mr. Darshan Solanki, on February 12, 2023.

The Institute is deeply anguished over his extremely tragic demise.

Our heartfelt prayers for peace to the departed soul and may his family and friends have the strength and fortitude to bear this grievous loss.