Indian Institute of Metals, Kanpur Chapter

Chapter Activities Report

(Apr 2023 - Mar 2024)

Prepared by

Secretary, IIM Kanpur Chapter

Annual Report (2023-2024)

Dear Members of the IIM Kanpur Chapter and Friends,

IIM Kanpur Chapter has continued to grow in 2023-2024, as in previous years. We organized several events over the past year, which received tremendous support from all the past and present members. We are immensely thankful to them. This report highlights some of our notable achievements during the current year.

One of our major achievements was the timely organization of the Annual General Meeting (AGM) and the Executive Committee (EC) members' meeting, which paved the way for seamless action and helped us align with the mission and vision of the IIM Kanpur Chapter and the larger IIM family. We successfully increased our membership, adding three faculty members from IIT Kanpur and a few new student members to our chapter. Additionally, nearly twenty scholars from our chapter participated in NMD-ATM 2023 held in Bhubaneswar, India, marking a significant commitment to IIM.

Our chapter has also remained active on social media and has maintained a healthy financial status despite engaging in numerous activities. The details of various events are enclosed in the report. The success of these events is due to the energetic student members who worked diligently to ensure their success.

In conclusion, I would like to thank all the executive members and volunteers who have worked tirelessly throughout the year to elevate the IIM Kanpur Chapter to greater heights. I am confident that we will continue to receive the same support in the coming year.

Sincerely,

Niraj Mohan Chawake
Secretary, IIM Kanpur Chapter

Executive Committee

(July 2023-Present)

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Table of Contents

1. Executive Committee (EC) Members Meeting

July 4, 2023, FB 421, IIT Kanpur

The IIM Kanpur Chapter held EC members meeting on July 4, 2023, attended by Dr. A. K. Singh, Mr. G. P. Bajpai, Dr. S. S. Singh, and Dr. K. Mondal. The primary agenda was to discuss the upcoming Prof. N. K. Batra Metals and Materials Quiz 2023 and the Annual General Meeting (AGM) for 2023.

The Prof. N. K. Batra Metals and Materials Quiz 2023 is scheduled to be held on August 12, 2023 (Saturday). To ensure the event's success, the Secretary of the IIM Kanpur Chapter (IIMKC) will circulate all necessary details to the schools in Kanpur to encourage participation. It was decided that the current Executive Committee (EC) would collaborate with the next EC for the smooth execution of the quiz. Furthermore, a committee for quiz questions and a science camp was proposed. The Quiz Questions Committee will comprise Prof. Sarang Ingole, Prof. Raghupathy Yuvraj, Prof. Niraj Chawake, Prof. Nilesh Badwe, and Prof. Arunabh Meshram. Meanwhile, the Science Camp Committee will include Prof. Shikhar Misra and Prof. Srinu Gangolu. Additionally, Dr. Mayank Dwivedi, Director of DMSRDE, will be approached to deliver a talk on the day of the quiz.

The AGM for 2023 is planned for July 17, 2023 (Monday) at 5 PM. Prof. Shashank Shekhar has been requested to oversee the election process for the next executive committee, and he has kindly agreed to take on this responsibility. To facilitate a smooth transition, nominations will be sought from IIMKC members for their inclusion in the next executive committee.

The meeting concluded with a well-defined plan for the upcoming Prof. N. K. Batra Metals and Materials Quiz and the AGM. The establishment of specialized committees and the cooperation between the current and next ECs are aimed at ensuring the effective organization and success of these events.

2. Annual General Meeting (AGM)

July 17, 2023, FB421, IIT Kanpur

The IIM Kanpur Chapter held a meeting on July 17, 2023, attended by Dr. A. K. Singh, Dr. Anish Upadhyaya, Dr. Krishanu Biswas, Dr. K. Mondal, Dr. T. Maiti, Dr. N. Chawake, Dr. Raghupathy Yuvraj, and Dr. S. S. Singh. The primary agenda was to discuss the composition of the new office bearers for the IIM Kanpur Chapter (IIMKC) for the term 2023-2025.

The new office bearers for the IIMKC for the period of 2023-2025 were decided as follows:

- **Chair:** Prof. Anish Upadhyaya
- **Vice Chair:** Prof. Krishanu Biswas
- **Secretary:** Prof. Niraj Chawake
- **Treasurer:** Prof. Raghupathy Yuvraj
- **Student Advisor:** Prof. Tanmoy Maiti

The meeting concluded with the finalization of these appointments, ensuring a smooth transition and leadership continuity for the IIM Kanpur Chapter.

3. Activities for students

3.1. Materials Camp

May 6-8, 2023, at FB 421 and ACMS, IIT Kanpur

Materials camp was organized by Material Advantage @ IIT Kanpur, IIM Kanpur Chapter, ASM International Kanpur Chapter and INAE Kanpur Chapter for 3-day during May 06-08, 2023 at IIT Kanpur. The "Materials Camp" attracted participation of 38 students and nine teachers from nine schools of Kanpur (i.e., DPS Azad Nagar, DPS Kalyanpur, Dr. Virendra Swaroop Education Centre, Jai Narayan Vidya Mandir, Kendriya Vidyalaya IIT Kanpur, Methodist High School, Seth Anandram Jaipuria, Shieling House, and Sir Padmapat Singhania). Comprehensive three-day 'Materials Camp' was highly packed. Shri Pradeep Goyal, Senior Vice President of ASM International, graced the event with his online presence for inaugurating the event on May 06, 2023. Prof. Kallol Mondal, Head, MSE Department emphasized the role of material and processing in attaining required performance. Prof. Amarendra Singh, Chair Indian IIM Kanpur Chapter, emphasized on the role of materials in civilization. Prof. Yogesh Joshi, Chair INAE Kanpur, elicited the convergence of all engineering fields through research in Materials Science. Prof. Sudhanshu S. Singh, Secretary IIM Kanpur Chapter, also attended the event.

The first day sessions involved talks on "Classification of Materials" by Prof. Niraj Chawake, followed by real-life demonstrations on materials in a mobile phone by Ms. Shruti Dubey and Ms. Pooja Rani. Then Prof. Kantesh Balani delivered a talk on, "Fascinating World of Materials", which followed an impromptu session by Prof. Anish Upadhyaya on challenges in materials. Thereafter, a session on sample preparation and microscopy of various samples in physical metallurgy laboratory, which was coordinated by Mr. Gyan P. Bajpai and Mr. Ajay P. Singh.

The second-day session highlights included demonstrations of Electrospinning, Wetting, Lab-safety and Scanning Electron Microscopy by Mr. P. Shiven, Mr. Govind, Mr. Ajay P. Singh, Ms. Pooja Rani, Ms. Shruti Dubey, Mr. Murli Manohar and Dr. Deepak Khare with assistance of Mr. Dinesh Diwakar and Mr. Raj Babu. In addition, parallel session of virtual lab on "Electron Microscopy for Beginners" was demonstrated by Mr. Dhananjay Umrao, Ms. Sheetal, Mr. Vinay Tripathi, Ms. Reena, Ms. Suman Tripathi, and Mr. Harsh Dwivedi, and was very well received by students.

The third day of the 'Materials Camp' was more on mechanical testing and manufacturing processes to appreciate the utility of processing techniques in changing material shape and attaining requisite performance. Shri Anil K. Verma, Shri S.K. Agnihotri, Shri I.P. Singh, Shri Rakesh K. Dixit, Shri Gaurav Mishra, Shri Gyanendra Singh, Shri Samardeep Shri Bharat R. Singh, and Shri Pappu Kannaujia anchored the event. Further, third day highlight was an industrial visit to Anode Plasma Spraying, wherein the surface preparation, and coating deposition techniques (such as plasma spraying, and flame spraying) on real-life components were demonstrated by Shri Ritik Tandon and Shri Viraj Tandon. The excitement was all evident in the eyes of participants and had not at all subdued even after three days of engaging sessions. The program ended with distribution of certificates to all the participants and concluded with a very positive note of satisfaction and grand success of 'Materials Camp'.

3.2. Prof. N. K. Batra Metals & Materials Quiz 2023

August 12, 2023, at L16, IIT Kanpur

Fostering Interest in Materials and Metallurgical Engineering amongst school students

The Indian Institute of Metals (IIM) Kanpur Chapter, in collaboration with the Department of Materials Science and Engineering at IIT Kanpur, successfully hosted the annual Prof. N. K. Batra Metals & Materials Quiz on August 12, 2023. The event witnessed lively participation from 28 teams representing 14 different schools in Kanpur. This prestigious quiz, designed for Class XI and XII students, aims to ignite a passion for Materials and Metallurgical Engineering.

Professor Anish Upadhyaya, Chairman of IIM Kanpur Chapter, welcomed the participants in his inaugural address, outlining IIM's role in advancing materials and manufacturing innovation. Established in 1948, IIM is a leading professional body dedicated to elevating India's global leadership in minerals, materials, and metallurgical engineering.

Prof. Kallol Mondal, Head of MSE Department, warmly greeted the participants and highlighted the legacy of late Prof. N. K. Batra, in whose honor the quiz is named. The opening program was successfully conducted by Prof. Niraj Chawake, Secretary of IIM Kanpur Chapter.

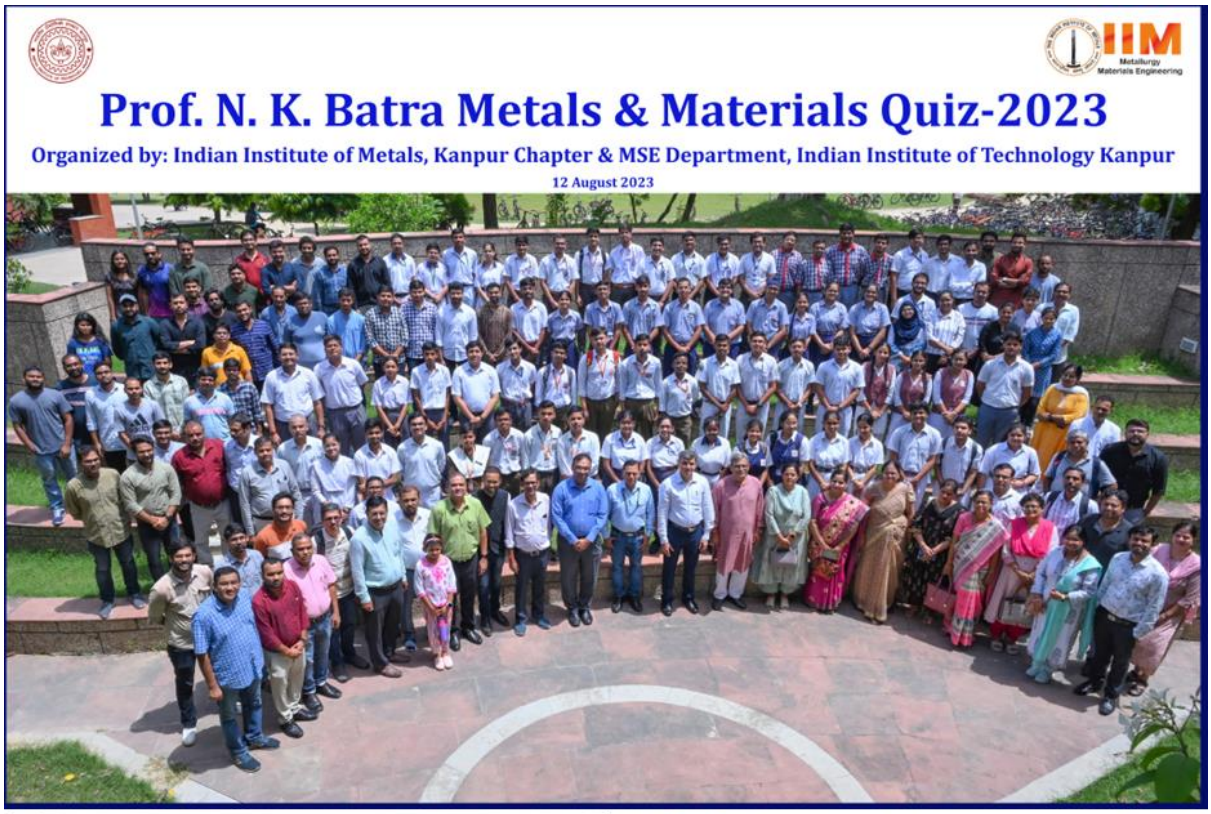
As a highlight of the event, Dr. Mayank Dwivedi (Director, DMSRDE, Kanpur) delivered a talk on the strategic role of materials in various applications. He engaged with school students, addressing their queries and shedding light on the importance of materials in diverse areas. An exhibition organized by MSE students showcased innovative models such as lemon sweet battery, simulation-based experiments, dressing materials, chromium removal from solution, and crystal structure models, fostering a deeper understanding of materials science.

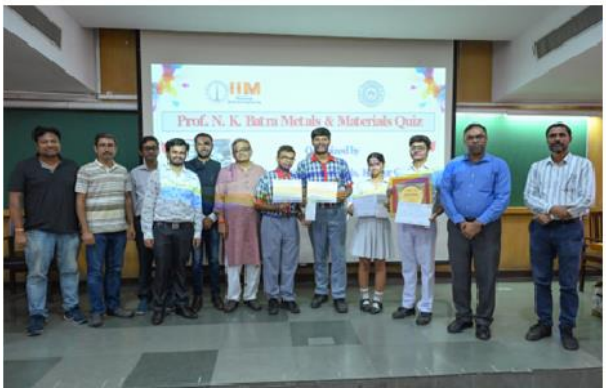
The quiz competition followed a multi-stage format, starting with a preliminary screening round, advancing through four stages. The enthusiastic participation resulted in the shortlisting of 10 teams after the written screening Test. This number was further reduced to seven, four, and finally two teams in subsequent rounds. The culminating stage featured rapid-fire questions, with quiz masters Prof. Sarang Ingole, Ms. Gulnaz, Mr. Faiz, Mr. Antrakrate, and Mr. Praveen skillfully engaging the audience.

The coveted first position in the Prof. N. K. Batra Metals & Materials Quiz 2023 was secured by Mr. Kushagra Kushwaha and Ms. Niharika Gupta from Delhi Public School, Kalyanpur,

Kanpur. The runners-up position was claimed by Mr. Mourya Banerjee and Mr. Om Upadhyaya of Kendriya Vidyalaya, IIT Kanpur. Prof. Rajeev Shekhar handed over the prize to winner and runners-up.

In his closing remarks, Prof. Krishanu Biswas, Vice Chairman of IIM Kanpur Chapter, extended gratitude to the dedicated student volunteers and MSE Department staff for their instrumental support. The volunteer team, guided by MSE faculty members including Prof. Sarang Ingole, Prof. Nilesh Badwe, Prof. Arunabh Meshram, Prof. Raghupathy Yuvaraj, Prof. Shikhar Misra, and Prof. Srinu Gangolu, contributed to the seamless execution of the event.





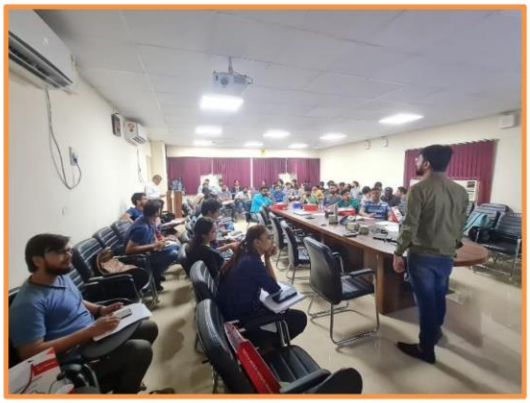
4. Workshops, seminars, conferences, Technical Talks

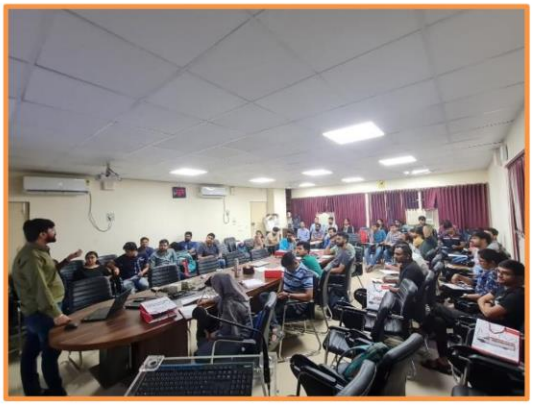
4.1. Workshop on Characterization of Coating Materials

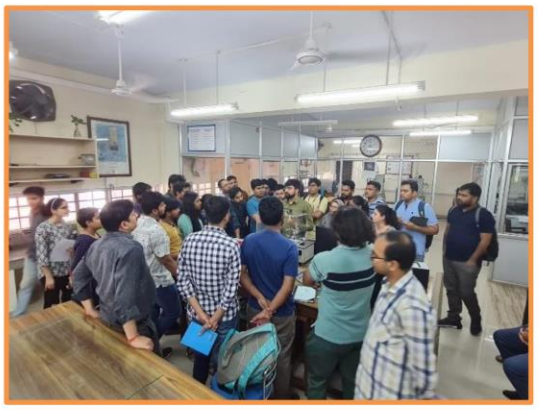
May 09, 2023, at FB421, IIT Kanpur

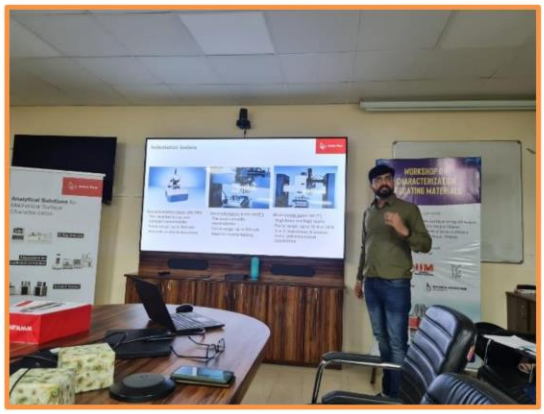
Indian Institute of Metals Kanpur Chapter jointly organized the workshop with Department of Materials Science and Engineering IIT Kanpur, Material Advantage, IIT Kanpur Chapter and Indian National Young Academics of Sciences (INYAS) in association with Anton Paar on Characterization of Coating Materials. The workshop was on mechanical characterization techniques for the development and quality control of coated materials. Dr. Kallol Mondal, HOD of the Department of Materials and Engineering at IIT Kanpur, Dr. Amarendra Kumar Singh, chair of The Indian Institute of Metals, IIT Kanpur Chapter, and Dr. Kantesh Balkani, faculty advisor of Material Advantage, IIT Kanpur Chapter, encouraged the students and demonstrated the importance of this workshop for the coating materials for structural Applications. The audience was given a brief introduction to the Indian National Young Academy of Sciences (INYAS) and the workshop by Dr. Sudhanshu Shekhar Singh.

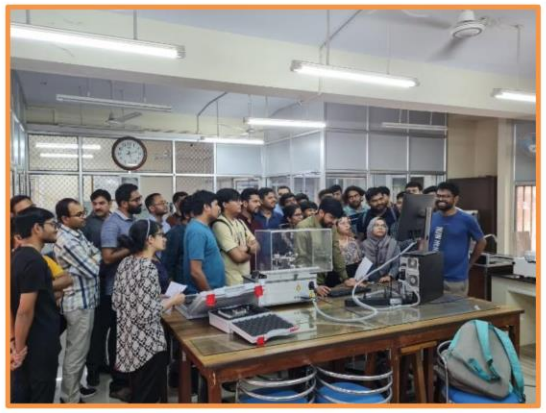
Dr. Ankit Jain, Mr. Jitendra Singh, and Mr. Abhishek Singh, all industry experts, were invited from Anton Paar. They conducted presentations to introduce the researchers to the X-ray diffraction spectroscopy equipment and the related solutions to combat different challenges related to various sample conditions for XRD analysis. The session provided participants with the opportunity to interact live with industry experts and gain practical experience. It featured practical training with a variety of cutting-edge surface characterization tools, including Calotest testers, nano-indentation, scratch testers, and tribometers. The mechanical characteristics of coatings, such as hardness, adhesion, wear resistance, and thickness, can be learned from these technologies in useful ways. There was also an online training for handling extremely complicated tribolometer and scratch tester equipment. The session was attended by about 40 research students. The participants found the workshop very useful and informative for their own research work.












PURPOSE: COLLABORATION
1. Challenges
WORKSHOP ON
CHARACTERIZATION
OF COATING MATERIALS

4.2. National Symposium of Research Scholars (NSRS-2024)

March 9-10, 2024, Lecture Hall Complex, IIT Kanpur

The National Symposium of Research Scholars on Metallurgy and Materials, held on March 9-10, 2024, was organized by the Department of Materials Science and Engineering at IIT Kanpur, in association with the Indian Institute of Metals-Kanpur Chapter, Material Advantage-Kanpur Chapter, and Materials Science Society-IIT Kanpur. The symposium aimed to serve as a platform for research scholars to showcase their work, exchange ideas, and foster collaborations in the field of materials science and metallurgy Notably, the symposium stood out as it was organized by and for research scholars themselves. It operated under the supervision of national and local advisory committees, comprising experts from across the nation and faculty members from prestigious institutions. Steering the symposium were Dr. Niraj Chawake (Convener), Dr. Arunabh Meshram (Co-Convener), and Dr. Srinu Gangolu (Secretary), under the leadership of Prof. Kallol Mondal, the Head of MSE at IIT Kanpur.

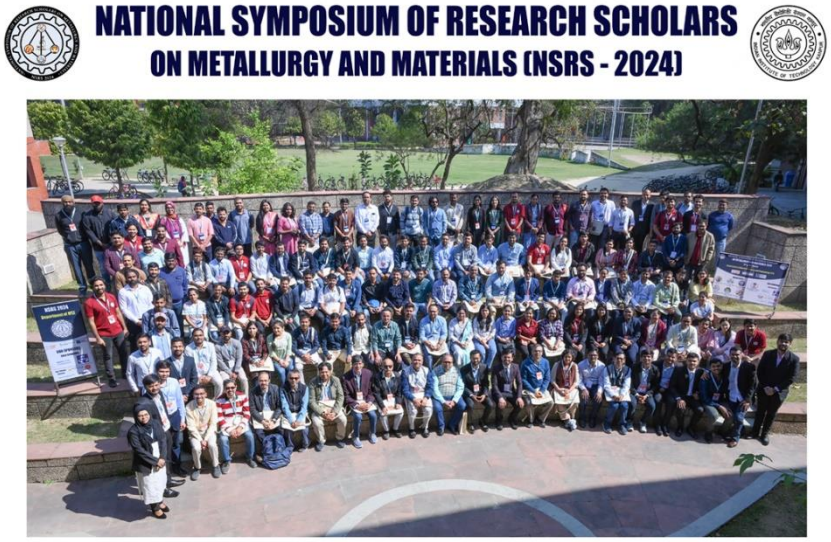
The symposium drew a total of 145 participants, comprising 63 oral presentations, 55 poster presentations, and 27 entries in the Metallographic contest. Participants came from various esteemed institutions including IITs at Delhi, Gandhinagar, BHU, Patna, Jodhpur, Madras, Kharagpur, Bombay, Mandi, Indore, Kanpur, as well as from NITs at Calicut, Trichy, Allahabad, and from research institutions such as CSIR-NML Jamshedpur, IMMT Bhubaneswar, LIT Nagpur, DIAT Pune, IISER Thiruvananthapuram, IISER Berhampur, IIEST Shibpur, HRI Allahabad, and universities like SRM and Sharda University.

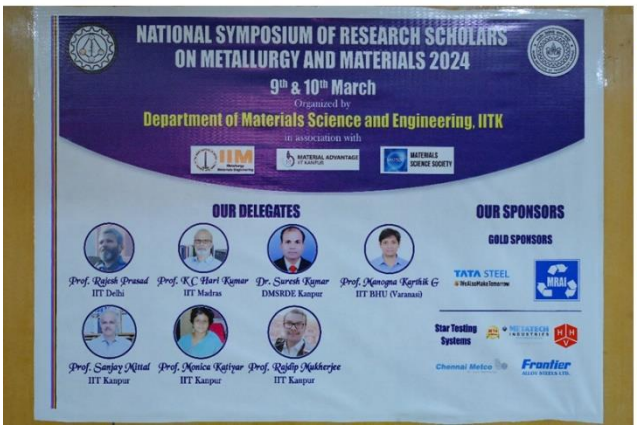
- **The Key Highlights of NSRS-2024:**
  - Distinguished plenary talks were delivered by Professor Rajesh Prasad (IIT Delhi), Professor K C Hari Kumar (IIT Madras), Professor Sanjay Mittal (IIT Kanpur), and Professor Monica Katiyar (IIT Kanpur).
  - Dr. Suresh Kumar, Scientist G from DMSRDE Kanpur, delivered a well-received talk during the event.
  - Panel discussions led by Professor Kantesh Balani and Professor Shivam Tripathi centered around pertinent topics such as work-life balance and opportunities for research scholars.
  - The symposium was graced by Professor Tarun Gupta (Dean Research and Development, IIT Kanpur), as the inaugural guest, while the valedictory guests were Professor Rajeev Shekhar (MSE, IIT Kanpur) and Professor Sandeep Sangal (MSE, IIT Kanpur).

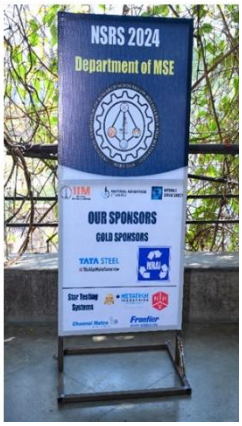
- **Technical Program:**

  The technical program encompassed oral and poster presentations covering a wide array of topics such as Energy Materials, Functional Materials, Process Metallurgy, Recycling of Materials and Sustainability, Mechanical Behaviour of Materials, Corrosion Engineering, and Computational Materials Science. Additionally, a metallography contest was also conducted.

  - A comprehensive abstract book has been published, featuring detailed information on the technical talks and the complete technical program of the symposium. You can access the abstract book via the following link: https://drive.google.com/file/d/1UKvygk9OPR0sCr5ft5ZZm1Sbtznz732r/view







4.3. IIM Talks

4.3.1. Dr. Surendra Kumar Makineni, IISc Bangalore

June 6, 2023, FB 421, IIT Kanpur

Title: Correlative EM and APT studies on defects, interfaces, and grain boundaries in multicomponent alloys.

Abstract: Correlative experimental techniques using electron microscopy (EM) and atom probe tomography (APT) from the same region of interest on the sample led to determine both the structural and three-dimensional compositional information at atomic scale. These techniques are advantageous when the microstructure is inhomogeneous and/or when targeting rare features that can influence overall material properties. In this talk, I will project some basic studies on defects, grain boundaries and interfaces in multicomponent alloys. Based on the results, atomic scale mechanisms are derived that can directly influence the properties.

About the Speaker: Dr. Surendra Kumar Makineni, Assistant Professor at the Department of Materials Engineering, Indian Institute of Science Bangalore, completed his Doctoral research at the Department of Materials Engineering, Indian Institute of Science Bangalore, India, in 2015. He did his post-doctoral research as an Alexander Von Humboldt Fellow at the Max Planck Institute for Iron Research, Germany, for a couple of years. His research area includes establishing a correlation of the effect of local structure and compositional changes directly to the material strength and creep properties of superalloys (Co- and Ni-based), Light Metal Alloys (Al- and Mg-based), and other engineering alloys such as Cu-based, High entropy alloys, etc. using advanced microscopy characterization methods. Presently, he is appointed as the Head of the MPG-IISc Partner Group, Department of Materials Engineering, Indian Institute of Science Bangalore, India.

4.3.2. Dr. Mayank Dwivedi, DMSRDE, Kanpur

Aug 12, 2023, L16, IIT Kanpur

Title: The strategic role of materials in Defence

About the Speaker: Dr Mayank Dwivedi, Scientist 'G' is appointed as Director, Defence Materials and Stores Research and Development Establishment. He is M.E. in Polymer Technology from DCE Delhi and Ph.D. in Advanced Composites from IIT Delhi. He is recipient of Gold Medal in M.E. He is alumni of the prestigious National Defence College, New Delhi. In his previous appointments, he was Director, Directorate of Industry Interface & Technology Management (DIITM)for more than 5 years and prior to it, he was Director, Defence Technology Commission (DTC), Secretariat for 2 years. He started his career from DST project in 1989 and later he joined DRDO (CPDC/ ASL, Hyderabad) in 1992. He has been working in polymeric composites and nano composites for last 34 years. He has worked in the area of stealth and radar absorbing systems. He has worked on major projects such as Agni missile, Brahmos Missile, warhead technologies and biomechanical devices. He has expertise in the areas of processing and structure-property relationship of advanced composites. He has contributed to the indigenization of high temperature resins systems and development of airframes. He has worked in identification and development of counter insurgency technologies and products.

4.3.3. Dr. Debdatta Ratna, NMRL Ambernath

Sept 6, 2023, FB421, IIT Kanpur

Title: Nanomaterials based Products for Naval Applications

Abstract: Nanomaterials exhibit properties that cannot be achieved with conventional materials. In the last few decades, considerable work has been done on the fundamental understanding of nanomaterials, their synthesis, and their applications. In the last few years, the major focus has been on the application of nanomaterials in various fields. In our laboratory, we recently completed a project on "Nanomaterial-based products for naval applications," in which we demonstrated various technologies where nanomaterials have been used to enhance the properties and performance of products for naval applications. We have worked on polymer nanocomposite technology using various nanofillers like layered silicates, carbon nanotubes, graphene, silver nanoparticles, and zirconium phosphate. The lecture will highlight the work

carried out in the above-mentioned area and, most importantly, the case studies for product development.

About the Speaker: Dr. Debdatta Ratna is currently working as Scientist G & Head, Polymer Science and Technology Directorate of Naval Materials Research Laboratory, Ambernath. Dr. Ratna obtained a Master of Science, a Master of Technology, and a Ph.D. from IIT Kharagpur and joined DRDO in 2000. His research interests lie in the science and engineering of polymeric blends, nanomaterials, and composites. He has received several awards and accolades, including the Silicon Medal from DRDO, the Humboldt Fellowship from the Alexander von Humboldt Foundation in 2006, and the BOYSCAST Fellowship from DST.

4.3.4. Prof. Rao Tummala, Georgia Tech

Nov 12, 2023, FB421, IIT Kanpur

Title: Next Gen, Global-level and Large-scale Device, Packaging and Systems R&D and Workforce development in India

Abstract: India has not been a global player in semiconductors and packaging. But it can be with the new ISM initiative in manufacturing and R&D. Prof. Rao Tummala believes that India can transform its electronics by transforming its academics into industry-centric culture, based on the Georgia Tech model, by performing massive global level R&D that India is capable of. But this R&D must be consistent with global industry needs in integrated systems packaging by highly- innovative, young, and energetic faculty and great executive Directors that India already has at its IITs and IISc. The proposal describes the strategic, next-gen global level R&D, education and skill development programs, infrastructure needed for these and the resulting IP creation and exponential growth in startups to attract many global companies to make India globally competitive. Indian Government is committed to invest in next gen R&D at its academic institutions with the state-of-the-art facilities, as well as state of the art facilities for technology development at ISRC thereby attracting companies both for R&D and manufacturing in both semiconductors and packages. With these investments, India, for the first time, has all the programs necessary for it to be a global player in the short term and global leader in the long term in integrated systems. If such an investment by the GOI is matched by the industry in a consortium mode, India can transform itself from its current design-centric to system centric with expertise and resources spanning from system design and architectures to system integration, assembly and test to offer system foundry for the world.

A proposal was developed by more than 50 academic faculty from India's top 13 academic institution and 20 colleges and universities under the advice and leadership of Prof. Rao Tummala, as a champion for vision, strategy, and programs, based on a highly successful Georgia Tech model for leading-edge R&D from concept to commercialization, education of large number cross-disciplinary students, and industry partnerships with about 10 global companies-all simultaneously.

The Indian proposal is expected to result in 12 India-wide Centers of Excellence in 12 different strategic technologies funded by GOI and global industries for $200 M. It is to be implemented by the proposal also involves partnership with more than 50 global companies including 12 from India, 14 leading US universities including partners from Purdue, Georgia Tech, Penn State, USC, University of Illinois, and the University of Texas and 24 global academic excellence, besides 12 strategic research areas (SRAs).

The proposed R&D and workforce development is to address the needs of explosive growth of government, universities and global companies. Rao Tummala believes that for the first time in India's history, leading Indian universities will begin to perform joint R&D and educate the needed workforce from a large number of students by collaborating with global industry – the two most important strategic needs for the global industry in systems packaging. R&D will create a new job market and provide jobs for their students in India. For global academic collaboration, it will facilitate the training and development of a large pool of educated students from India as their Ph. D students and post docs, and India will become a global leader in this packaging, large scale global- level R&D, unlike most, if not all countries, and attract large investments from companies that are looking for low-cost, highly skilled workforce. In turn, India can claim to have set up the complete ecosystem from research to technology development to manufacturing, just like in advanced countries, in semiconductors and packaging to grow its economy to capture a significant portion of $27T market, to become 3rd largest economy by 2030.

About the Speaker: Prof. Rao Tummala is a Distinguished and Endowed Chair Professor, founder of the Packaging Research Center at Georgia Tech and a fellow of IEEE, IMAPS, and the American Ceramic Society. Earlier he worked at IBM for 25 years where he was an IBM fellow and Director of Advanced Packaging Lab. He pioneered industry's First Plasma Display and First LTCC with 100 chips. Prof. Tummala obtained his B.E. from IISc Bangalore and Ph.D. from University of Illinois. He has created a model at Georgia Tech for a very large and

successful global industry consortium that educated 10,000 engineers in more than 20 different packaging courses.

The center has graduated 900 Ph.D. & M.S. packaging engineers supplying to almost all electronic companies in the US. IEEE named him Father of Modern Packaging and created IEEE Rao Tummala Electronic Packaging Award, a technical field award. Prof. Tummala has more than 800 scientific papers, 7 Textbooks and has more than 100 US patents to his credit.

4.3.5. Prof. Rajeev Gupta, North Carolina State University

Dec 21, 2023, FB421, IIT Kanpur

Title: Feedstock modification to control the corrosion of additively manufactured alloys

Abstract: Additive manufacturing such as laser powder bed fusion is gaining popularity and has the potential to replace conventional manufacturing. The properties of metallic materials produced through additive manufacturing (AM) depend on various parameters, including the type of AM technique, processing parameters, built environment, and the feedstock used. Selection of the appropriate feedstock could be a potential strategy to enhance properties and reduce the impact of processing parameters on those properties. Ongoing research in the presenter's group has demonstrated that feedstock modification by several additives, such as CrN, can significantly improve the corrosion resistance of 316L stainless steel. The role of feedstock modification in controlling microstructure and corrosion will be discussed.

Bio of the speaker Dr. Rajeev Gupta is an associate professor of Materials Science and Engineering at North Carolina State University. Rajeev received his B.Tech. in Materials and Metallurgical Engineering from IIT Kanpur and a Ph.D. in Materials Engineering from Monash University, Australia. Before joining the faculty at NC State University, he was an assistant professor at the University of Akron. He is also an associate editor of the Journal of the Electrochemical Society. Rajeev is the recipient of the NSF CAREER award, ECS Rusty award, AMPP Educator Award, and ACA Brian Cherry Award. Rajeev’s primary research interests lie in the broad areas of corrosion and material engineering. His research group focuses on understanding the structure-processing-property-performance relationships in metallic materials, high-temperature corrosion, and surface electrochemistry. The fundamental research is intended to be applied in developing new materials, corrosion characterization techniques, material processing technologies, and life prediction models.

4.3.6. Dr. Amit Datye, Yale University

Jan 05, 2024, FB421, IIT Kanpur

Title: Nano-microscale testing of thermoplastically formed pillars and atomically smooth bulk metallic glasses

Abstract: This seminar will discuss the advances in nanomechanical testing of bulk metallic glasses. The deformation behavior of Pt57.5Cu14.7Ni5.3P22.5 metallic glass was investigated under micro-/nanopillar compression, where pillars were prepared using a novel method based on thermoplastic forming. This manufacturing method not only produces better-defined pillar geometries with lesser structural flaws that could affect deformation properties than conventional manufacturing approaches, but it also enables the fabrication of a large number of pillars in a short time. By controlling strain rate, the critical load for the formation of shear transformation zones and pillar yielding behavior was analyzed. The nanoscale deformation behavior of Pt57.5Cu14.7Ni5.3P22.5 metallic glass was also investigated using nanoindentation and AFM-based techniques, using samples with "atomically" smooth surfaces. To access the intrinsic local properties of the bulk, the study using AFM techniques introduces stiffness mapping as a novel avenue to investigate the local heterogeneity of metallic glasses and applies it at three different fictive temperatures (Tf) as a proof-of-principle. Nanoindentation techniques using high-speed mapping (microscale) and high strain rate testing will also be discussed.

About the speaker: Dr. Amit Datye is currently an Associate Research Scientist in the Department of Mechanical Engineering and Materials Science at Yale University and also the Associate Director of the Yale Mechanical and Thermal Analysis Instrumentation Core. He received his PhD in Materials Science and Engineering under the guidance of Dr. George Pharr at the University of Tennessee, Knoxville with most of the PhD research conducted at the Alloy Behavior and Design Group at Oak Ridge National Laboratory. Prior to joining the PhD program at the University of Tennessee, he worked at the Ceramic Science and Technology Group at Oak Ridge National Laboratory. He joined Yale University after a brief one-year period at Cornell University. He is an author or co-author of more than 50 scientific publications (including 4 book chapters) in prestigious journals like Nature Communications, Nature Communications Materials, Nature Communications Physics, etc. His current research focuses on bulk and nanoscale mechanical and material characterization techniques, nanomechanics, and advanced manufacturing techniques like nanoimprinting, non-equilibrium processing, and additive manufacturing.