



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad



MATERIALS SCIENCE & METALLURGICAL ENGINEERING

Indian Institute of Technology Hyderabad
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MESSAGE FROM HOD DESK

NAMASKAR!

Greetings from the Department of Materials Science and Metallurgical Engineering (MSME), Indian Institute of Technology Hyderabad, INDIA!

I feel privileged to introduce the MSME department. Initially, as Materials Science and Engineering (MSE), the MSME department started in 2010 with M.Tech. (5 students) and Ph.D. programs (6 Scholars) and the recruitment of two faculty in that year. Over 12 years, MSME currently boasts three prolific Distinguished Professors, four reputed Adjunct Professors, 21 dynamic Faculty, 13 enthusiastic Staff, three knowledgeable Research Associates, 70 energetic Ph.D. Scholars, 63 industrious M.Tech. Students and 95 brilliant B.Tech Students.

Our academic curricula cover broad fields of materials science and metallurgical engineering, from fundamentals to advanced and emerging areas such as nanomaterials, biomaterials, energy materials, electron microscopy, thermomechanical processing, thin films and devices, metal extraction and recovery from wastes, to name a few, which impart strong foundation on several significant aspects of materials science and metallurgical engineering and enhance the state of the knowledge of the students.

Through the available flexible fractal academic program following T-based education in IIT Hyderabad, our department not only covers the breadth of different futuristic areas like Additive Manufacturing, Integrated Computational Materials Engineering, Semiconductor Materials and Devices, E-waste Resources Engineering and Management, and so on, but also make them stand firm by imparting in-depth knowledge on the fundamental aspects of Materials Science and Metallurgy. Moreover, most of the teaching courses contain practical components. Along with the lab practical and project-based thesis (one year in M.Tech. program), the students are given ample opportunity to gain hands-on expertise in all the instruments and techniques. In addition, to become industry-ready, the students are also trained in communication skills through the given formal courses, seminars, and technical writing professional ethics/plagiarism courses.

With the motto of "Atoms to Applications," over the years, the MSME family, through its faculty, staff, and researchers, has spread its wings in all aspects of Materials and Metallurgy. In research, equipped with several state-of-the-art instruments, the MSME is standing firm on the three main pillars of Structural Materials, Functional Materials, and Computational Materials, with its offshoots spread towards Nanoscience & Nanotechnology, Sustainable Metallurgy, Healthcare Materials, Materials Processing, Advanced Materials Characterization, Energy Materials, Electrochemical Materials Engineering, Advanced Alloys & Composites and so on.

We sincerely hope that the information given in this brochure shall bring out all the aspects and facts of our department and is helpful. Do not hesitate to revert in case of requiring any further information.

Sincerely,

Suhash Ranjan Dey
head@msme.iith.ac.in

Bachelor of Technology Materials Science & Metallurgical Engineering

Course Objectives:

Providing a firm foundation in the fundamentals and applications of current metallurgical and materials science theories, inculcating multidisciplinary skills required for contributing to advanced materials and metallurgical technology, both nationally and globally.

Duration: 4 years (8 semesters)

Entrance: Admissions through JEE Advanced.

Master of Technology Materials Science & Metallurgical Engineering (MoE)

The department offers a two years program in Master of Technology in Materials Science and Metallurgical Engineering. Students get the opportunity to learn various advanced level courses and carry out thesis in various cutting-edge areas.

Eligibility & Admission:

1. Candidates having B.E./B.Tech. or equivalent in Metallurgy/Ceramics/ Mechanical / Production / Industrial/Plastics/Polymer/or related discipline or M.Sc. in Materials Science/Physics/Chemistry
Valid GATE score required in MT/ME/PI/PH/CY/XE.
2. Selection is based on **GATE SCORE**.
3. Visit <https://www.iith.ac.in/academics/post-graduate/> for more details.

Master of Technology Materials Science & Metallurgical Engineering (Self Sponsored)

The Department offers two years program in Master of Technology in Materials Science and Metallurgical Engineering. Students get the opportunity to learn various advanced level courses in various cutting-edge areas.

Eligibility & Admission:

1. Candidates having B.E./B.Tech. or equivalent in Metallurgy/Ceramics/Mechanical / Production / Industrial/Plastics/ Polymer/ or related discipline or M.Sc. in Materials Science/Physics/Chemistry or related discipline with minimum first class.
2. Selection is based on Written test (and/or) interview. **GATE SCORE NOT MANDATORY.**
3. Visit <https://www.iith.ac.in/academics/post-graduate/> for more details.

Master of Technology Semiconductor Materials & Devices

The program aims to nurture expertise in Semiconductor Materials and Devices, one of essential resources to make India as the global hub for Electronic Systems and Manufacturing. The program is in line with the recent expansion of the vision of Aatmanirbhar Bharat in setting up of India Semiconductor Mission.

Eligibility & Admission:

1. Self-Sponsored: Candidates having B.E./B.Tech. or equivalent in Metallurgy /Ceramics/Mechanical/Production/Industrial/Electrical/Electronics/Instrumentation Engineering/Polymer or related discipline or M.Sc. in Materials Science/Nanotechnology/Physics/Chemistry or related discipline with minimum first class.
2. Selection is based on Written test (and/or) interview. **GATE SCORE NOT MANDATORY FOR SELF SPONSORED CANDIDATES.**
3. Visit <https://www.iith.ac.in/academics/post-graduate/> for more details.

Master of Technology Industrial Metallurgy (Online)

This online M. Tech program is specially designed for working professionals to help them to master the essentials of industrial metallurgy. It caters to the needs of working professionals in metallurgical, materials, and manufacturing industries who wish to upskill themselves. The program covers both fundamental scientific principles and applied engineering aspects. It offers great flexibility in terms of courses. It includes a wide range of elective courses spanning across fundamental metallurgical principles, materials processing, materials testing and characterization, new-generation high-performance alloys, and computational materials engineering.

Eligibility & Admission:

1. Working professionals in public- and private-sector industries, R&D labs, and academic institutions with more than two years of work experience and a first-class bachelor's degree (BTech, BE or equivalent) in metallurgical engineering, metallurgical and materials engineering, materials science and engineering, mechanical engineering, manufacturing engineering, production engineering, industrial engineering, chemical engineering, and allied disciplines are eligible to apply.
2. Selection is based on Written test (and/or) interview. **GATE SCORE NOT MANDATORY.**
3. Visit <https://www.iith.ac.in/academics/post-graduate/> for more details.

Master of Technology Integrated Computational Materials Engineering (Interdisciplinary Program)

The Masters program in ICME at IIT Hyderabad is a unique and cutting-edge interdisciplinary program designed exclusively for professionals working in industries and research organizations. The program provides state-of-the-art training on computational engineering for accelerated design, and development of engineering materials. Students learn how to apply physics-based Multiscale Modelling techniques, High-throughput Experimentation and Artificial Intelligence for Virtual Materials and Process Design for various critical sectors including automotive, aerospace, maritime, defense and healthcare.

Eligibility & Admission:

- 1.This program is for professionals working in the industry or research organization with a minimum of two years of professional experience.
- 2.Candidate should have a BTech/BE or equivalent degree or ME/MTech/MS or equivalent degree in Metallurgy/Materials/Mechanical/Aerospace/Production/Ceramic Eng. or any other allied Engineering discipline and should have secured first-class in their bachelor's degree.
- 3.**GATE score is not required.**
- 4.Visit <https://www.iith.ac.in/academics/post-graduate/> for more details.

Doctor of Philosophy Materials Science & Metallurgical Engineering

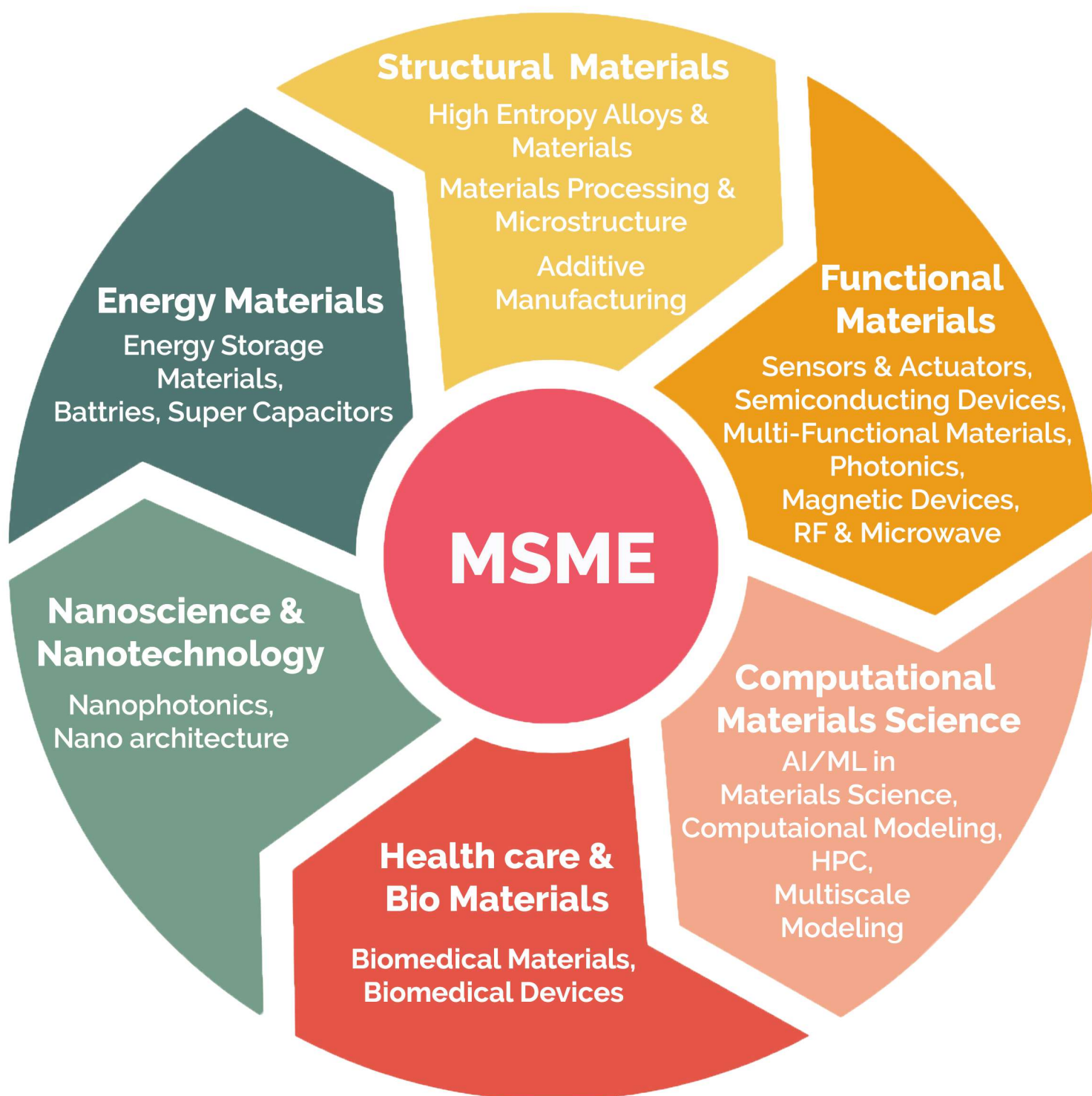
The Doctor of Philosophy (Ph.D.) program is for enthusiastic students, who are willing to take up challenging research problems in various areas of Materials Science and Metallurgical Engineering, as mentioned in the research profiles of the faculty members (but not limited to). New ideas, inventions and innovations are most welcome. Specific research areas will be mentioned at the time of the interview.

Eligibility & Qualifications:

Candidates interested in Institute scholarship (MoE) and Candidates with external funding (DST-INSPIRE/joint CSIR-UGC JRF QUALIFIED/industry sponsorship/external registrants from national research laboratories) with required qualifications are highly encouraged to apply.

Externally funded candidates are encouraged to contact their preferable MSME faculty before exam/interview schedule. Visit <https://www.iith.ac.in/phdadmissions/home.jsp> for more details.

RESEARCH AREAS





Prof B S Murty

Professor

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RESEARCH INTERESTS

- Nanocrystalline materials.
- High entropy alloys.
- Bulk metallic glasses.
- Thermodynamics and kinetics of phase transformations.
- Transmission electron microscopy and atom probe tomography.

RECENT RESEARCH PROJECTS

- Principal Investigator: Support to NFAPT, BRNS, 2018-2023.
- Principal Investigator: Development of Self-cleaning coatings, IREL, 2018-2022.
- Principal Investigator: Development of ODS steels, UAY, 2018-2022.
- Principal Investigator: Development of HEAs for high temperature aircraft applications, Imprint, 2018-22.

SELECTED RECENT PUBLICATIONS

- Talluri, G., Babu, D.A., Hariharan, V.S., Murty, B.S., Maurya, R.S. A simplistic accelerated design methodology for eutectic multi-principal element alloys, JALCOM, 960 (2023) 170834.
- S.M. Shaik, B.S. Murty, S.K. Yadav, Designing a thermodynamically stable and intrinsically ductile refractory alloy, J. Alloys Compd. 939 (2023) 168597.
- Kuruva, H., Khavala, V.B., Mishra, B.R., Murugan, K. Thomas, T., Murty, B.S. Photocatalytic degradation of multi-organo-sulfur industrial wastewater using TiO₂ produced from modified sulfate process, J. Water Process Eng., 53 (2023) 103805.
- V.S. Hariharan, B. Nithin, L. Ruban Raj, Surendra Kumar M. Gandham Phanikumar, B.S. Murty, Modeling Microsegregation during Metal Additive Manufacturing: Impact of Dendrite Tip Kinetics and Finite Solute Diffusion, Crystal 13 (2023) 842.
- P. Lava Kumar, A. Lombardi, G. Byczynski, S.V.S. Narayana Murty, B.S. Murty, L. Bichler, Recent advances in aluminium matrix composites reinforced with graphene-based nanomaterial: A critical review, Prog. Mater. Sci. 128 (2022) 100948.

AWARDS & RECOGNITIONS

- Shanti Swarup Bhatnagar award, National Metallurgist Award, JC Bose Fellowship, GD Birla Gold Medal.
- Distinguished Alumnus award of IISc & VNIT and Lifetime Achievement award of IIT Madras.
- MRSI Medal, Young Metallurgist Award, INSA Young Scientist award INAE Young Engineer award.
- Fellow of The World Academy of Sciences, Fellow of Asia Pacific Academy of Materials, Fellow of ASM International, Honorary Doctorate, Deakin University
- FNAE, FNA, FASc, FNASc, FEMSI, FIIM, FAPAS.



Prof. Pinaki Prasad Bhattacharjee

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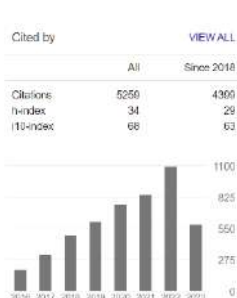
RESEARCH INTERESTS

- High Entropy Alloys (HEA) and advanced metallic alloys
- Thermo-mechanical processing, microstructure and crystallographic texture
- Bulk ultrafine, nanostructured, and heterogeneous materials by severe plastic deformation
- Mechanical behavior of materials

RESEARCH PROJECTS

- Tuning crystalline-amorphous band heterogeneous nanostructure in extremely low SFE High Entropy Alloys for achieving strength-ductility synergy, SERB-STAR, 2021-24, 38.65 Lakhs, Ongoing.
- Tuning heterogeneous nanostructure via strain-partition engineering for developing cobalt-free cost-effective eutectic high entropy alloys with outstanding strength-ductility synergy, DST-SERB, 2020-23, 26 Lakhs, Ongoing.
- Development of High Entropy Alloys with Multiscale Heterogeneities, DRDO, 2020-23, 72 Lakhs, Ongoing
- Investigating the evolution of heterogeneous microstructure in metallic alloys by thermomechanical processing using correlative FIB-SEM and in-situ TEM techniques, DRDO, 2021-24, 92 Lakhs, Ongoing.

SELECTED PUBLICATIONS



■ **Books:** High Entropy Alloys, 2nd edition, B.S. Murty, J.W. Yeh, S. Ranganathan, **P.P. Bhattacharjee**, Elsevier, 2019.

■ The Status of Bulk Metallic Glass and High Entropy Alloys Research, S. R. Reddy, **P. P. Bhattacharjee**, and B. S. Murty, The INAE Volume on Structural Materials, Springer, 2022.

■ **Journal Papers:** Development of ultrafine grained cobalt-free AlCrFe₂Ni₂ high entropy alloy with superior mechanical properties by thermo-mechanical processing, B. Tripathy, S.R.K. Malladi, **P.P. Bhattacharjee**, *Materials Science and Engineering A.*, 831 (2022), 142190.

■ "High Entropy Alloys: key issues under passionate debate", K. Biswas, J-W Yeh, **P.P. Bhattacharjee**, J. Hosson, *Scripta Materialia* 188 (2020) 54-58.

- Ultrafine grained AlCoCrFeNi_{2.1} eutectic high entropy alloy, I.S. Wani, T. Bhattacharjee, S. Sheikh, Y. Lu, S. Chatterjee, **P.P. Bhattacharjee***, S. Guo, N. Tsuji, *Materials Research Letters* 4 (2016) 174-179.

AWARDS & RECOGNITIONS

- Faculty Research Excellence Award, IIT Hyderabad, 2023, Teaching Excellence Award, IIT Hyderabad, 2022,
- ASM-IIM visiting lectureship Award to USA, 2022, Science and Technology Award for Research (STAR), SERB-STAR, Department of Science and Technology (DST), Government of India, for 2021.
- Japan Society for the Promotion of Science (JSPS) Invitation Fellowship 2022-23.
- Amongst the top 2% of the scientists in the area of Materials Science and Engineering prepared by Stanford University, USA.



Prof. Suhash Ranjan Dey

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RESEARCH INTERESTS

- **Electrochemical Materials Design & Processing** (High Entropy Alloy Design & Fabrication- 0D, 1D, 2D and 3D).
- **Metals Recovery from Scraps/E-Wastes** (Solar PVs, LiBs, magnets and mine tailings).
- **4D printing of NiTi Shape Memory Alloy.**
- **Materials Stability Studies in Harsh Environment** (Corrosion, small scale mechanical testing).

RESEARCH PROJECTS

- An Incubation Support for a Start-Up under NICE (NMDC Innovation and Incubation Centre) Program; Funding agency: **NMDC and i-TIC Foundation (IIT Hyderabad)**. Co-Founder: Dr. Suhash Ranjan Dey (Starting date: **April 2021**); Sanctioned amount: **INR 25 lakhs** for two years
- Title: "Anti-viral coatings of electrochemically reduced metal nanoparticles for respirators"; Funding agency: Interdisciplinary Project, IIT Hyderabad (Starting date: **1st June 2020 for 2 years**); Sanctioned amount: **INR 10 lakhs** with Dr. Raghavendra N.K. (Biotechnology, IIT Hyderabad) as a co-PI.
- Title: "Microstructural evolution and structure-property correlations in FeCoNi based multi component alloy thin films"; Funding agency: Indo-Sweden **DST-VR** Joint Call (Starting date: **December 2020 for 3 years**); Sanctioned amount: **INR 43,67,840** for three years with Chalmers University of Technology, SWEDEN.
- Title: "Tuning the magnetic properties of nanocrystalline multi-component alloy thin film coatings through a single step electrodeposition for sensor applications"; Funding agency: **MHRD-SPARC** (Scheme for Promotion of Academic and Research Collaboration) (Starting date: **March 2019 for 4 years**); Sanctioned amount: **INR 50 lakhs** for two years with Shanghai Jiao Tong University, CHINA

SELECTED PUBLICATIONS

- Advances on multi-dimensional high-entropy alloy nanoarchitectures: Unconventional strategies and prospects. C.L.P. Pavithra and **Suhash R. Dey***, **Nano Select**; 4 (1), 2023, 48-78.
- Strategies to Engineer FeCoNiCuZn High Entropy Alloy Composition Through Aqueous Electrochemical Deposition. Reddy Kunda Siri Kiran Janardhana, Chokkakula L. P. Pavithra*, and **Suhash Ranjan Dey***, **Electrochimica Acta**, 2023, Accepted. (**IF 7.336**)
- One-dimensional Co-Cu-Fe-Ni-Zn high entropy alloy nanostructures. Chokkakula L.P. Pavithra, Reddy Kunda Siri Kiran Janardhana, Kolan Madhav Reddy, Chandrasekhar Murapaka, Xiadong Wang and **Suhash R. Dey***, **Materials Research Letters**, 9(7), 2021, 285-290. (**IF: 8.516**)

AWARDS & RECOGNITIONS

- Selected as **Associate Editor** in the Editorial Board of **Bulletin of Materials Science** (Impact Factor 1.878).
- **Bhaskara Advanced Solar Energy (BASE) Fellowship 2014** from Department of Science and Technology (DST), India and the Indo-U.S. Science and Technology Forum (IUSSTF).
- **IEI Young Engineers Award 2013-14** from the Institution of Engineers (INDIA) in Metallurgical & Materials Engineering discipline. The award consists of INR 10,000/- and a Citation.



Prof. Ranjith Ramadurai

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RESEARCH INTERESTS

- Multiferroic oxide thin films for fundamental science and functional device applications.
- High-k dielectric thin films for CMOS technology and memory device applications.
- Surfaces and Interfaces of oxide hetero structures on silicon and single crystalline oxide substrates.
- Influence of process conditions, strain engineering and interface engineering on domains and domain dynamics of multiferroic thin films utilizing scanning probe microscope

RESEARCH PROJECTS

- Synthesis of novel multifunctional nano-composites and study the influence of size, shape, strain and organization on functional behavior at nano-scale for magneto-dielectric device applications", DRDO-ERIPR program Ongoing (May 2018 –April 2021 (extended up to Oct2021). (INR~ 37.42 Lakhs)
- Strain, Microstructure and Defect Induced Effects on Ferroic Domains of Morphotropic Phase Compositions in Lead Free Ferroelectric Thin Films" – DST, EMR (36 months, Project sanctioned (March 2019 – March 2022) (INR 59 Lakhs)
- Investigations on Influence of Cationic Ordering, Anisotropy and Strain in Functional Domains of Multiferroic Relaxor Thin Films and Bulk ceramics for Magneto-Dielectric based Device Applications" – DST, Fast track project Nov 2013 – Oct 2016 (36 months) (INR~ 16 Lakhs)

SELECTED PUBLICATIONS

- $\text{Ba}_{0.85}\text{Ca}_{0.15}\text{Zr}_{0.1}\text{Ti}_{0.9}\text{O}_3$ (BCZT)/ $0.94(\text{Na}_{0.5}\text{Bi}_{0.5})\text{TiO}_3$ - 0.06BaTiO_3 (NBT-BT) heterostructures for the applications of vibration sensing and energy harvester.
- Growth of crack free $\text{Nd}_2\text{Ti}_2\text{O}_7$ thin films using $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_{3\pm\delta}$ as a template layer for high temperature pyroelectric applications.
- Enhanced optical emission at MoS_2 - WS_2 heterostructure interface with nN junction.
- $\text{Ba}_{0.85}\text{Ca}_{0.15}\text{Zr}_{0.1}\text{Ti}_{0.9}\text{O}_3/\text{CoFe}_2\text{O}_4/\text{Ba}_{0.85}\text{Ca}_{0.15}\text{Zr}_{0.1}\text{Ti}_{0.9}\text{O}_3$ Nanoscale Composite Films with 2–2 Connectivity for Magnetoelectric Actuation.
- Ferroelectric polarization of β -polyvinylidene fluoride as control and mitigator of infectious organisms.

AWARDS & RECOGNITIONS

- Chosen as a Visiting Faculty for the year 2020 in Unit of Catalysis and Solid Chemistry, University of Artois, Lens, France.
- MRSI – Medal" Materials Research Society of India (MRSI) – Medal for young Materials Researcher for the year 2016.



Prof. Bharat B. Panigrahi

Professor

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RESEARCH INTERESTS

- Metal Additive Manufacturing, Post-processing, Powder Metallurgy, Sintering, High Entropy Alloys, Inconel Superalloys, Titanium Alloys, Ultra High Temperature Composites, Nanostructured Materials, Microstructure-Mechanical Properties of austenitic and martensitic steels, Coatings, Wear and Tribology, Hard Carbide Tool Materials, MAX Phases, 2D MXenes for energy storage.

RESEARCH PROJECTS

- High entropy carbide based cutting tool inserts, SERB - SUPRA, 73L (ongoing).
- Post-Processing of Direct Energy Deposition Components: Need Identification and Process Selection, SERB-CRG 43.4L(ongoing).
- Development of fibers reinforced alumina and zirconia matrix composites for high temperature applications, DRDO, 118.2 L (ongoing).
- Synthesis and sintering of ultrafine grained MAX phase compounds, SERB, 52.4L (completed).

SELECTED PUBLICATIONS

- M. Jadhav, S. Singh, M. Srivastava, Chethan, R.P.S. Chakradhar, Bharat B. Panigrahi, Effect of minute element addition on the oxidation resistance of FeCoCrNiAl and FeCoCrNi2Al high entropy alloy, Advanced Powder Technology, 33, Issue 2, February 2022, 103410.
- S. Aamani, C.R. Das, S. K. Martha, S.K. Albert, B.B. Panigrahi, Influence of Nitrogen on Grain Size-Dependent Sensitisation and Corrosion Resistance of 316L (N) Austenitic Stainless Steels, Trans Indian Inst Met (2022).
- S.S.N. Murthy, Manish Patel, T. Sreekantha Reddy, V.V. Bhanu Prasad, Bharat B. Panigrahi, Processing and characterization of carbon fibres reinforced ZrB₂ ultra high temperature ceramic matrix composite, Ceramics International, (2021).
- Chandrakant, N.S. Reddy, B. B. Panigrahi, Electro spark coating of AlCoCrFeNi high entropy alloy on AISI410 stainless steel, Materials Letters, 304 (2021) 130580.
- Subhendu Naskar, S. Rohila, S. Suryakumar, B. B. Panigrahi, Influence of Heat treatments on Microstructure and Mechanical Properties of Additive Manufactured Inconel 718 Superalloy, Trans. INAE (2021).

AWARDS & RECOGNITIONS

- Promising Young Powder Metallurgy Professional Award (PMAI)
- Compromisso com a Ciência (Commitment to Science fellowship, Portugal)
- BK-21 Brain Korea Fellowship (South Korea)
- Prof. G. S. Tendolkar Best Paper Award (PMAI)
- Best / Outstanding Reviewer Awards (several international journals).



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RESEARCH INTERESTS

- Energy storage materials (batteries and supercapacitors)
- High entropy oxides
- Superhydrophobic materials
- Nanomaterial synthesis
- Carbon based materials.

RESEARCH PROJECTS

- Self-cleaning superhydrophobic coatings for automotive applications, Eaton Pvt. Ltd, (2.03 Lakh)
- Pressure less fabrication of carbon foam using bituminous coal for ablative applications, DRDO, (54.6 Lakhs)

SELECTED PUBLICATIONS

- Hard carbon derived from sepals of Palmyra palm fruit calyx as an anode for sodium-ion batteries, Damodar D., Ghosh S, Usha Rani M. Martha S.K. and Deshpande A.S. Journal of Power Sources 438, 227008 (2019)
- Wetting transition from lotus leaf to rose petal using modified fly ash, Mahanta U, Khandelwal M, Deshpande A.S. ChemistrySelect 4 (27), 7936-7942(2019)
- Corn husk derived activated carbon with enhanced electrochemical performance for high-voltage supercapacitors, Usha Rani M, Nanaji K, Rao TN, Deshpande AS. Journal of Power Sources. 471:228387, (2020).
- Structural and luminescent properties of Eu³⁺ doped multi-principal component Ce_{0.2}Gd_{0.2}Hf_{0.2}La_{0.2}Zr_{0.2}O₂ nanoparticles, Anandkumar, M., Bagul, P. M., Deshpande, A. S.; Journal of Alloys and Compounds, 838, 155595(2020)
- TiO₂@SiO₂ nanoparticles for methylene blue removal and photocatalytic degradation under natural sunlight and low-power UV light, Mahanta U, Khandelwal M, Deshpande AS. Applied Surface Science. 576:151745, (2022).



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RESEARCH INTERESTS

- Phase transformations in materials, Computational Modeling of Phase Transformations
- Development of phase field models of microstructural evolution, Microstructure-informed micromechanical modeling
- Prediction of process-microstructure-property relations: development and implementation of high-performance integrated computational materials engineering (ICME) tools for materials design
- Acceleration of physics-based models of microstructural evolution using machine learning and deep learning techniques

RESEARCH PROJECTS

- Assessment of high-fidelity diffusion coefficients in ternary and multicomponent Ni-Al-X (X=Mo, Ta, Re, W) alloys and their effect on Ostwald ripening (SERB, DST)
- Through-process modeling of DS/SC superalloy turbine blades processed using modified Bridgman route – Validation with CMSX-4 alloy (GTMAP, ARDB)
- Repository of high-performance phase field solvers for Microstructure Simulations (NSM, DST)
- Computational Microstructural Design of P/M Disk Superalloys using Phase Field Modeling towards Accelerated Alloy Design (CARS, DMRL, DRDO)
- Accelerated Alloy Design and Processing Optimization Using Computational Thermodynamics and Kinetics - Based Tools (MIDHANI)

SELECTED PUBLICATIONS

- Pankaj, P., Bhattacharyya, S., Chatterjee, S. Competition of core-shell and Janus morphology in bimetallic nanoparticles: Insights from a phase-field model (2022) Acta Materialia, 233, art. no. 117933
- Kumar, H., Dash, A., Paul, A., Bhattacharyya, S. A physics-informed neural network-based numerical inverse method for optimization of diffusion coefficients in NiCoFeCr multi principal element alloy (2022) Scripta Materialia, 214, art. no. 114639
- Verma, M., Sugathan, S., Bhattacharya, S., Mukherjee, R. A computational analysis of universal behavior of thermal groove in a moving grain boundary (2022) Scripta Materialia, 209, art. no. 114383

AWARDS & RECOGNITIONS

- Excellence in Teaching Award in 2020 from IIT Hyderabad (12th Foundation Day)
- Lead Collaborator at ICME National Hub @ IIT Kanpur from 2018 till date
- Guest Editor for the Journal of Indian Institute of Science for a special issue on Phase Field Modeling (2016)



Dr. Mudrika Khandelwal

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RESEARCH INTERESTS

- Material for Health Care, (Drug Delivery, Antimicrobial Materials).
- Materials for Energy and Motion, (Anode for Battery, Flexible Electronics).
- Materials for Environment, (Depth Filters, Food Packaging).
- Materials for special needs, (Paper Restoration, Hydroponic Surfaces).

RESEARCH PROJECTS

- Biodegradable Self Sanitizing Bacterial Nano Cellulose fabric for air and water filtration, NTTM, Ministry of textiles, 2 years, Feb 2023-Feb 2025.
- Bacterial cellulose derived tunable nanostructured carbon as high performance anode for lithium ion battery, DST-SERB, 3 years, March 2019-March 2022.
- Polymer and carbon based three dimensional micropatterned fabric with enhanced wettability contrast, DST-UKIERI, 2 years, April 2015-April 2017
- Novel low cost antifouling materials for health care and food packaging industry, SERB, 4 years, April 2015-April 2019

SELECTED PUBLICATIONS

- Bharti, V. K., Pathak, A. D., Anjan, A., Sharma, C. S., & Khandelwal, M. (2022). Covalently Confined Sulfur Composite with Carbonized Bacterial Cellulose as an Efficient Cathode Matrix for High-Performance Potassium–Sulfur Batteries. *ACS Sustainable Chemistry & Engineering*, 10(50),16634–16646.
- Najathulla, B. C., Deshpande, A. S., & Khandelwal, M. (2022). PEDOT: PSS/Bacterial Cellulose-based soft actuator under triangle and square wave: Deflection, response, and fidelity. *SyntheticMetals*,286,117053.
- Adepu, S., & Khandelwal, M. (2018). Broad-spectrum antimicrobial activity of bacterial cellulose silver nanocomposites with sustained release. *Journal of Materials Science*, 53(3), 1596–1609.
- Adepu, S., & Khandelwal, M. (2020). Bacterial cellulose with microencapsulated antifungal essential oils: A novel double barrier releasesystem. *Materialia*,9,100585.
- Mudrika Khandelwal, Shivakalyani Adepu, Pharmaceutical Compositions and Delivery Systems for Prevention and Treatment of Candidiasis Indian Patent 201841034939, Date of filing: Sept 17 201PCT application: PCT/IB2019/057802 US patent application: 17276478 Date of filing: Mar 15, 2021.

AWARDS & RECOGNITIONS

- Women Excellence Award, SERB, 2022, INAE Young Engineer Award, Indian National Academy of Engineers, 2020.
- NASI-Young Scientist Platinum Jubilee Award, National Academy of Sciences India, 2020, INYAS member, Indian National Science Academy, 2018-till date.



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RESEARCH INTERESTS

- Metallurgy of welding, additive manufacturing and solidification processing
- Alloy design and phase transformations
- Thermodynamic, kinetic and microstructural modeling
- Phase transformations in thin films
- Electron and ion beam microscopy and analysis

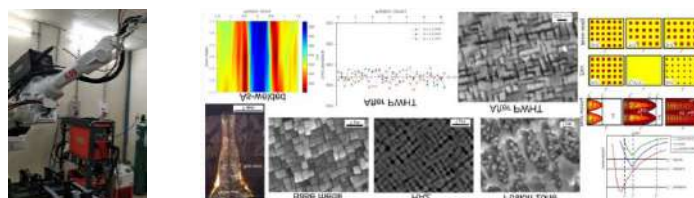
RESEARCH PROJECTS

- Design, Manufacturing and Microstructural Analysis of Novel Hard Coatings on Titanium Produced by Weld Deposition Techniques. SERB, 2016-2019, 44.04 Lakh.
- Process-microstructure-property relationship in welds (WP7) under National Center for Clean Coal Research and Development (a consortium of IISc and IITs). SERB, 2017-2023, 99.97 Lakh.

SELECTED PUBLICATIONS

- Competition of Core-Shell and Janus Morphology in Bimetallic Nanoparticles: Insights from a Phase-Field Model. P. Pankaj, S. Bhattacharyya, **S. Chatterjee**. *Acta Materialia*, **233**, 117933, 2022. IF: 9.209. doi: 10.1016/j.actamat.2022.117933.
- Laser welding of a W-free precipitation strengthened Co-base superalloy. K.S. Athira, P. Pandey, K.V. Prabhakar, K. Chattopadhyay, **S. Chatterjee**. *Journal of Materials Science*, **57**, pp. 7085-7100, 2022. 4.682. doi: 10.1007/s10853-022-07117-8.
- Microstructure and mechanical behaviour of an advanced powder metallurgy nickel base superalloy processed through hot isostatic pressing route for aerospace applications. B. Sreenu, R. Sarkar, S.S.S. Kumar, **S. Chatterjee**, G.A. Rao. *Materials Science and Engineering A*, **797**, p. 140254, 2020. IF: 6.044. doi: 10.1016/j.msea.2020.140254.
- Effect of Build Geometry and Porosity in Additively Manufactured CuCrZr. A. Kulkarni, V.C. Peddiraju, **S. Chatterjee**, D. Srinivasan. *International Manufacturing Science and Engineering Conference*, American Society of Mechanical Engineers, 86601, V001T02A007, 2022. doi: 10.1115/IAM2022-93986.
- Effect of Heat Treatment on Structure and Properties of Laser Powder Bed Fusion Inconel 939. E.N. Kumar, K.S. Athira, **S. Chatterjee**, D. Srinivasan. *International Manufacturing Science and Engineering Conference*, American Society of Mechanical Engineers, 86601, V001T02A003, 2022. doi: 10.1115/IAM2022-93945.

RESEARCH PHOTOS





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RESEARCH INTERESTS

- Deformation Behavior of Materials at room temperature as well as at high temperature
- Creep, Superplasticity
- Development of alloys for high temperature applications
- Micromechanical deformation
- MD simulations.

RESEARCH PROJECTS

- Evaluation of creep behavior of AlCoCrFeNiMo0.5 high strength high entropy alloy, ECR-SERB, 52 lakh
- Investigation of the high temperature deformation and creep behavior of Fe-Mn-Al-C low density steels , SRG-SERB, 47 lakh
- Near net shape manufacturing of grain-oriented transformer grade electrical steel, DST, 55 Lakh
- Mechanical properties and textural variation at different locations of fuel chamber 2 lakh

SELECTED PUBLICATIONS

- Korla Rajesh, Chokshi Atul H, Strain-rate sensitivity and microstructural evolution in a Mg–Al–Zn alloy, Scripta Mater., 63, 913-916, 2010.
- Korla Rajesh, Chokshi Atul H., A constitutive equation for grain boundary sliding: an experimental approach, Metall Mater Trans., A45, 698-708, 2014
- Prasad K Eswar, Rajesh K, Ramamurty U, Micropillar and macropillar compression responses of magnesium single crystals oriented for single slip or extension twinning, Acta mater, 65, 316-325, 2014.
- Wilkinson Angus J, Collins David M, Zayachuk Yevhen, Korla Rajesh, Vilalta-Clemente Arantxa, Applications of multivariate statistical methods and simulation libraries to analysis of electron backscatter diffraction and transmission Kikuchi diffraction datasets, Ultramicroscopy, 196, 88-98, 2019
- Ramakrishna M, Koppoju Suresh, Telasang Gururaj, Korla Rajesh, Padmanabham G, Effect of solutionizing temperature on the microstructural evolution during double aging of powder bed fusion-additive manufactured IN718 alloy, Mater Char. 172, 110868, 2021.
- Raineesh KP, Sairam K, Rajesh K, Prasad K Eswar, Novel approach to characterize the deformation under Berkovich and spherical indentations: Study on magnesium single crystals, Phy Rev Mater, 5, 083604, 2021.
- Palguna Yasam, Kotla Sairam, Korla Rajesh, High temperature deformation behavior of Al0.2CoCrFeNiMo0.5 high entropy alloy: Dynamic strain ageing, J Alloys and Comp, 930, 167422, 2023.
- Sairam Kotla, Phaniraj MP, Rajesh Korla, Effect of molybdenum on recrystallization behavior of Fe30Mn5Al1C-x Mo lightweight austenitic steels, Scripta Mater, 230, 115399, 2023.



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RESEARCH INTERESTS

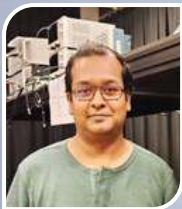
- Development and application of in-situ electron microscopy for various Materials related problems. Current research focuses on two domains:
- Liquid cell electron microscopy with applications ranging from investigating the nucleation and growth of nanoparticles to understanding the charges at solid-liquid interfaces using both static graphene-based liquid cells and MEMS-based liquid flow holders.
- In situ and Ex Situ Corrosion Studies of Metallic Alloys and Materials for Energy applications.

RESEARCH PROJECTS

- **"New insights into the localised corrosion of advanced metallic alloys using electron microscopy"**, Sai Rama Krishna Malladi, ECR/2017/002628, INR 52.47 Lakhs
- **"12th Asia-Pacific Microscopy Conference (APMC-2020)"**, Sai Rama Krishna Malladi, SSY/2019/001394, INR 4 Lakhs
- **"12th Asia-Pacific Microscopy Conference (APMC-2020) during Feb 03-07,2020"**, Sai Rama Krishna Malladi, SYM/10572/19-HRD, INR 5 Lakhs
- **"12th Asia-Pacific Microscopy Conference (APMC-2020) during Feb 03-07,2020"**, Sai Rama Krishna Malladi, 52/17/77/2019-BRNS/11228, INR 8 Lakhs
- **"Tuning heterogeneous nanostructure via strain-partition engineering for developing cobalt-free cost-effective eutectic high entropy alloys with outstanding strength-ductility synergy"**, Pinaki Prasad Bhattacharjee (PI), Sai Rama Krishna Malladi (co-PI), CRG/2020/000665, INR 25.8 Lakhs
- **"Investigating the evolution of heterogeneous microstructure in metallic alloys by thermomechanical processing using correlative FIB-SEM and in-situ TEM techniques"**, Sai Rama Krishna Malladi, DRDO/DFTM/05/3424/AMP/008/M/01/IITHRC-013, INR 81.14 Lakhs

SELECTED PUBLICATIONS

- Chunhui Liu, Sairam K Malladi, Qiang Xu, Jianghua Chen, Frans Tichelaar, Xiaodong Zhuge, Henny Zandbergen. In situ STEM imaging of growth and phase change of individual CuAl_x precipitates in Al alloy; Scientific Reports 7 (2017).
- Roland Hellmann, Stephane Cotte, Emmanuel Cadel, Sairam Malladi, Lisa S Karlsson, Sergio Lozano-Perez, Martiane Cabie, Antoine Seyeux. "Nanometre-scale evidence for interfacial dissolution-precipitation control of silicate glass corrosion." Nature Materials 14 (2015): 307- 311
- Sairam K Malladi, Qiang Xu, Marijn A van Huis, Frans D Tichelaar, K Joost Batenburg, Emrah Yücelen, Beata Dubiel, Aleksandra Czyrska-Filemonowicz, and Henny W Zandbergen; Real-Time Atomic-Scale Imaging of Nanostructural Evolution in Aluminum Alloys; Nano Letters 14, no. 1 (2013): 384-89.
- SRK Malladi, FD Tichelaar, Q Xu, MY Wu, H Terryn, JMC Mol, F Hannour, and HW Zandbergen; Quasi in situ Analytical Tem to Investigate Electrochemically Induced Microstructural Changes in Alloys: Aa2024-T3 as an example; Corrosion Science 69 (2013): 221-25.



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RESEARCH INTERESTS

- Nanoplasmonics and nano photonics
- Alternative nanofabrication techniques and chemical synthesis
- Optical sensors and modulators
- Nanophotonic opto-electronic devices

RESEARCH PROJECTS

- Multi-axial strain sensing using photonic crystal rubber, JICA Phase 2 Project (JICA), 7.94 Lakhs (PI)
- Simultaneous monitoring of multiple cytokines via SERS signals using critically coupled optical perfect absorber sensor substrates, DST-Nanomission, 47.44 Lakhs (PI)
- Spinodal decomposition in Cu-Ag alloy thin films: A route to tunable plasmonics, SERB-ECR, 49.7 Lakhs (PI)
- Development of 3D-bioprinted artificial pancreas with nanosensors for real-time monitored insulin release: In vitro model replacing animal models for diabetic treatment, IIT Hyderabad (SOCH Grant), 99.44 Lakhs (Co-PI)

SELECTED PUBLICATIONS

- Pravallika B., S. Bhattacharya and S. Dutta-Gupta#, Insights into propagating surface plasmons in Ag- Cu alloy thin films: Enhancement of spin angular momentum of light, Journal of Applied Physics, 132, 183101 (2022).
- Pravallika B., Govind U., S. R. K. Malladi, S. Dutta-Gupta#, Microstructure dictates the behavior of plasmons in Ag-Cu alloy thin films, Journal of Physical Chemistry C, 126, 37, p. 15915–15923 (2022).
- Jagathpriya L. M., P. Jaya Kumar and S. Dutta-Gupta#, Tailoring cavity coupled plasmonic substrates for SERS application, Nanotechnology, 34, p. 335501 (2023).
- Jayakumar P. and S. Dutta-Gupta#, Controlled assembly of gold nanoparticles in resonant gold nanoapertures for SERS applications, Nanotechnology, 33, 485301 (2022).
- Eshita Mukherjee, P. Jaya Kumar, Dhruv Bhatnagar and S. Dutta-Gupta#, In-situ optical spectroscopy for monitoring the assembly of gold nanoparticles for plasmonic applications, Journal of Applied Physics, 133, 073101 (2023). (# - Corresponding author)

AWARDS & RECOGNITIONS

- Foreign thesis examiner for a thesis from EPFL, Switzerland (2023).
- Supervised Govardhan Reddy S. (B.Tech. student) who received the best B.Tech. thesis award from INAE in 2021
- Referee citation from JALCOM 2021
- Ramanujan Fellowship from DST-SERB (2018)
- Distinguished referee award by EPJAP (2018)



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RESEARCH INTERESTS

- Spintronic based memory and logic devices
- Domain wall and skyrmion dynamics in ferromagnetic nanostructures
- Spin-orbit torque induced magnetization dynamics
- Spin-pumping and Spin Hall effect
- Organic spintronics and spinterface

RESEARCH PROJECTS

- Agency: Early Career Research Award, SERB, DST, India (completed), Title: Spin-orbit torque induced magnetization dynamics in perpendicular magnetic anisotropy materials for non-volatile memory and logic applications (PI) Duration: 3 years, Total budget: ~ Rs. 50 lakh
- Agency: Regular Research Project BRNS, DAE, India (On-going), Title: Harnessing pure spin current by tailoring molecular spinterface (PI), Duration: 3 years, Total budget: ~ Rs. 30.03 lakh
- Agency: Core Research Grant CRG, SERB, DST, India (On-going), Title: Ferrimagnet based synaptic device for neuromorphic computing (PI) Duration: 3 years, Total budget: ~ Rs. 64.83 lakh
- Agency: JICA, Japan Friendship 2.0 (On-going), Title: Novel spin Hall materials for spin-orbit torque based memory and logic devices (PI) Duration: 2 years, Total budget: ~ Rs. 20 lakh
- Agency: Scheme for Promotion of Academic and Research Collaboration (SPARC) (completed), Title: Tuning the magnetic properties of nanocrystalline multi-component alloy thin film coatings through a single step electrodeposition for sensor applications (Co-PI) Duration: 2 years Total budget: ~ Rs. 50 lakh

SELECTED PUBLICATIONS

- B Paikaray, K. Mahathi, A Haldar, Chandrasekhar Murapaka*, "Skyrmion based majority logic gate by voltage controlled magnetic anisotropy in a nanomagnetic device", Nanotechnology 34, 225202 (2023)
- Talluri Manoj, Hari Prasanth Perumal, Bibekananda Paikaray, Arabinda Haldar, Jaivardhan Sinha, Pinaki Prasad Bhattacharjee, Chandrasekhar Murapaka*, "Perpendicular magnetic anisotropy in a sputter deposited nanocrystalline high entropy alloy thin film", Journal of Alloy and Compounds, 167337 (2023)
- B Paikaray, K. Mahathi, A Haldar, Chandrasekhar Murapaka*, "Reconfigurable logic operations via gate controlled skyrmion motion in a nanomagnetic device", ACS Applied Electronic Materials 4, 2209 (2022)
- K. Sriram, Jay Pala, Bibekananda Paikaray, Arabinda Haldar, Chandrasekhar Murapaka*, "Effect of seed layer on Ta crystalline phase and spin Hall angle", Nanoscale 13, 19985 (2021)

AWARDS & RECOGNITIONS

- Visiting faculty to NIMS Japan through IITH-NIMS collaboration
- Received Gold medal for Best Ph.D. thesis in physics from Materials Research Society Singapore
- DST- INSPIRE faculty award (2017), Received Early Career Research Award from SERB



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RESEARCH INTERESTS

- Diffusion in bulk and nanocrystalline materials
- Oxidation behavior of multicomponent alloys
- Interdiffusion in technologically important systems
- Alloy development and phase stability
- High entropy alloys

RESEARCH PROJECTS

- Development of Borated Steel (Volta Engg. Design, 21 lakhs, July 2022 – June 2023)
- Development of oxidation resistant nanocrystalline medium entropy alloys through diffusion analysis (UGC-DAE, Grant awarded for use of SIMS facility at UGC-DAE, Indore, and a nominal amount of Rs. 3 Lakhs, April 2022 – March 2024)
- Atomic transport and phase growth in deformed transition metals (DST-SERB (SRG), 30 lakhs, Dec 2020 – Dec 2022)
- Using diffusion multiples to investigate interdiffusion in nanocrystalline materials produced by spark plasma sintering (IIT Hyderabad (Seed Grant), 25 Lakhs, May 2020 – May 2022)

SELECTED PUBLICATIONS

- N. K. Chaitanya, B. Yadav, P. P. Bhattacharjee, M. Vaidya, Effect of ultrafine microstructure on interdiffusion-driven phase transformations in Ni-Sn sandwich diffusion couples, Mater. Today Commun. (2023): 105843.
- B. Yadav, N. K. Chaitanya, M. Sadhasivam, J. Joardar, K. Guruvidyathri, K. G. Pradeep, M. Vaidya, Accelerated Phase Growth Kinetics During Interdiffusion of Ultrafine-grained Ni and Sn, J. Alloys Compd. 948 (2023) 169690.
- M. Vaidya, A. Karati, K. Guruvidyathri, M. Nagini, K.G. Pradeep, B.S. Murty, Suppression of σ -phase in nanocrystalline CoCrFeMnNiV high entropy alloy by unsolicited contamination during mechanical alloying and spark plasma sintering, Mater. Chem. Phys. 255 (2020) 123558.
- M. Vaidya, Guruvidyathri K., B.S. Murty, Challenges in design and development of high entropy alloys: A thermodynamic and kinetic perspective, Scripta Mater. 188 (2020) 37-43
- M. Vaidya, Sandipan Sen, Lena Frommeyer, Lukas Rogal, S. Sankaran, Blazej Gabrowski, G. Wilde, S. V. Divinski, Phenomenon of ultra-fast tracer diffusion of Co in HCP high entropy alloys, Acta Mater. 196 (2020) 220-230.

AWARDS & RECOGNITIONS

- **INSA (Indian National Science Academy) Young Scientist Award – 2022**
- **Research Excellence Award – 2023**, by IIT Hyderabad, **Teaching Excellence Award – 2023**, by IIT Hyderabad
- **DAAD Research Ambassador** for a period of 3 years (2022 – 2025)
- Received **best publication award** from Dept. of MME, IIT Madras for the paper titled “Ni tracer diffusion in CoCrFeNi and CoCrFeMnNi high entropy alloys” published in Journal of alloys and compounds (2016)



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RESEARCH INTERESTS

- Carbon Capture
- Gas separation by adsorption/membrane process
- CVD synthesis
- Porous materials

RESEARCH PROJECTS

- Graphdiyne membranes for gas separation applications, Seed Grant (25 Lakhs)
- O₂/N₂ Separation with Nanoporous Materials by Hindering Lattice Flexibility In Metal-Organic Frameworks, SRG, SERB (Rs. 31.6 lakhs)

SELECTED PUBLICATIONS

- Ingle, D. S.; Yadav, A. C.; Kumari, K.; Singh, S. K.; Babu, D. J.; Rao, K. V. Post-Synthetic π -Extension of Perylene Conjugated Porous Polymer via APEX Reactions: Tunable Optical and Gas Storage Properties. *Chem. Commun.* 2023, 59 (4), 454–457.
- Villalobos, L. F.; Babu, D. J.; Hsu, K.-J.; Van Goethem, C.; Agrawal, K. V. Gas Separation Membranes with Atom-Thick Nanopores: The Potential of Nanoporous Single-Layer Graphene. *Acc. Mater. Res.* 2022, 3 (10), 1073–1087.
- Srideep, D.; Sriram, K.; Kotha, S.; Babu, D. J.; Singh, S. K.; Rao, K. V. Synthesis and Self-Assembly of Benzoperylene Benzimidazoles: Tunable Morphology with Aggregation-Induced Enhanced Emission. *Chemistry – An Asian Journal* 2022, 17 (8), e202200099.
- Hao, J.; Babu, D. J.; Liu, Q.; Schouwink, P. A.; Asgari, M.; Queen, W. L.; Agrawal, K. V. Mechanistic Study on Thermally Induced Lattice Stiffening of ZIF-8. *Chem. Mater.* 2021, 33 (11), 4035–4044.
- Huang, S.; Li, S.; Villalobos, L. F.; Dakhchoune, M.; Micari, M.; Babu, D. J.; Vahdat, M. T.; Mensi, M.; Oveisi, E.; Agrawal, K. V. Millisecond Lattice Gasification for High-Density CO₂- and O₂-Sieving Nanopores in Single-Layer Graphene. *Sci Adv* 2021, 7 (9), eabf0116.
- Hao, J.; Babu, D. J.; Liu, Q.; Chi, H.-Y.; Lu, C.; Liu, Y.; Agrawal, K. V. Synthesis of High-Performance Polycrystalline Metal–Organic Framework Membranes at Room Temperature in a Few Minutes. *J. Mater. Chem. A* 2020, 8 (16), 7633–7640.
- Babu, D. J.; He, G.; Hao, J.; Vahdat, M. T.; Schouwink, P. A.; Mensi, M.; Agrawal, K. V. Restricting Lattice Flexibility in Polycrystalline Metal–Organic Framework Membranes for Carbon Capture. *Advanced Materials* 2019, 31 (28), 1900855.



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RESEARCH INTERESTS

- **Printed and flexible electronics:** Preparation of metal oxide, organic semiconductors and 2D materials based electronic devices using printing/solution processes.
- **Nanostructured materials:** Preparation of nanoparticles and thin films by solution-based methods such as sol-gel, precipitation, hydrothermal methods and preparation of inks as well.
- **Characterization of materials and thin films:** Electrical and structural characterization of different materials and thin films to understand structure-property relations.
- **Sensors:** Organic field-effect transistor (OFET) based sensors to detect volatile organic compounds and different gases. Electronic nose using OFET based sensor arrays.
- **Memristors:** Preparation and characterization of metal oxide memristors and 1T1R devices for different applications (radiation detection, gas sensing and artificial synapses).

RESEARCH PROJECTS

- Dr. Suresh Kumar Garlapati (PI), *Completely printed/solution processed, transparent, and flexible metal oxide memristors at or near room temperature*, 25 lakhs INR, IITH, 2021-2023.
- Dr. Suresh Kumar Garlapati (PI), *A general route towards low voltage, high-current power printed electronics*, 30 lakhs INR, SERB, 2021-2023.
- Dr. Oves Badami, Dr. Suresh Kumar Garlapati (Co-PI), Dr. Praveen Tammana, *Development of a complete authentication system using printed RRAM based PUFs*, 20 lakhs INR, IHUB NTIHAC Foundation IIT Kanpur, 2023-2025.

SELECTED PUBLICATIONS

- Dr. Suresh Kumar Garlapati (PI), Dr. Venkata Rao Kotagiri, Dr. Gajendranath Chowdary, *Printed, wearable sensor array for non-invasive monitoring of diabetic complications and chronic kidney diseases*, 65 lakhs INR, approved by MHRD STARS, 2023-2026.
- Ozer, E., et. al., (2023) **Nature Communications**, 14(1):777. [IF: 17.69]
- Garlapati, S. K., et al., (2022). In *Microactuators, Microsensors and Micromechanisms: MAMM 2022 Springer International Publishing*.
- Rahmanudin, A., et. al., **Advanced Electronic Materials**, 2020, 6(3), 1901127. [IF 7.295]
- Garlapati, S. K., et al., (2018). **Advanced Materials**, 30(40), 1707600. [IF: 32.09]

AWARDS & RECOGNITIONS

- Achieved the status of **Associate Fellow of The Higher Education Academy (AFHEA)** in recognition of attainment against the UK Professional Standards framework for teaching and learning support in higher education.
- Recipient of a grant for conference fee and travel to attend DPG (German Physical Society) conference in 2013 in Germany.



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RESEARCH INTERESTS

- Process Modeling & Simulation
- Extraction & Molten Metal Treatment
- Continuous Casting, Inclusion Engineering & alloy steel development
- Hot-slag engineering, Metal Recycling & Life Cycle Analysis of Metallurgical Processes

RESEARCH PROJECTS

- 2023-2024 Mineralogical and Microstructural Studies of High Alumina Iron Ore Fines and their Effect on Pelletizing, Tata Steel Ltd, Jamshedpur, Rs. 30.94 lakhs (PI).
- 2022-2024 Reductive/Direct Alloying Technique for Making Lightweight (low-density) Steel; Seed grant IIT H, Rs. 30.00 lakhs (PI).
- 2020-2022 Development of CS analytical and Charpy Impact Specimen physical standard in steel; CSIR-HQ (4M theme FTT projects), Rs. 99.40 lakhs (PI)#.
- 2016-2020 Development of Hydrogen Standard in Steel; CSIR-HQ (4M theme FTT & FTC projects), Rs. 95.20 lakhs (PI) #.
- 2016-2019 Dip Mold Simulator-based Technique for Qualification of Mold Powders for Crack-sensitive Grade Steels; Tata Steel Ltd, Jamshedpur, Rs. 35.00 lakhs (PI) #. # projects handled at CSIR-NML, Jamshedpur

SELECTED PUBLICATIONS

- The Role of Slag Carryover on the Non-metallic Inclusion Evolution and Magnetic Behavior in Electrical Steel: Ashok Kamaraj *, Premkumar M, G K Mandal, G G Roy: *Materials and Metallurgical Transactions B* (2022), p. 1989-2003.
- Investigation on Mould Flux Melting and Consumption during Continuous Casting of Liquid Steels: Ashok Kamaraj *, Ansuman Dash, Premkumar M, Siddhartha Misra: *Materials and Metallurgical Transactions B* (2020) Vol. 51B, p. 2159-2170.
- Control of Slag Carryover from BOF Vessel during Tapping: BOF Cold Model Studies: Ashok Kamaraj *, G.K. Mandal, G G Roy: *Materials and Metallurgical Transactions B*, (2019) Vol. 50B, p. 438-458.
- Characterization and Assessment of Mold Flux for Continuous Casting of Liquid Steel Using an Inverse Mold Simulator: Ashok Kamaraj *, S. Tripathy, G. Chalavadi, P. P. Sahoo, S. Misra: *Steel Research International* (2021) Vol. 93, 3, p. 2100121. * Corresponding author

AWARDS & RECOGNITIONS

- Young Metallurgist of the Year 2021 by Ministry of Steel, Government of India
- One of the editors of IIM Metal News since May 2023, One of the top 3 nominees (Finalist) for the Institution of Engineering and Technology (IET) India Awards 2022 for the Youth Engineering Icon Award category, Nov 2022.



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RESEARCH INTERESTS

- Electronic Structure, Atomistic and Multi-Materials Modeling.
- Defects, Disorder and Doping of Semiconductors and Alloys
- Thermodynamic Modeling of Point Defects
- Computational Approaches to Accelerate Materials Discovery and Design
- Materials for Clean Energy, Electronics, and Quantum applications

SELECTED PUBLICATIONS

- S. Roychoudhury, S. Shulda, Anuj Goyal, R. Strange, J. E. Park, E. N. Coker, S. Lany, D. Ginley, David Prendergast, "Investigating the Electronic Structure of Prospective Water- splitting Oxide $\text{BaCe}_{0.25}\text{MnO}_{0.75}$ Before and After Thermal Reduction", *Chemistry of Materials*, 35, 5, 1935-1947 (2023). DOI:10.1021/acs.chemmater.2c03139
- A. Goyal, A. Zakutayev, V. Stevanovic and S. Lany, "Computational Fermi level engineering and doping-type conversion of $\text{Mg:Ga}_2\text{O}_3$ via three-step synthesis processing", *Journal of Applied Physics* 129, 245704 (2021). DOI: 10.1063/5.0051788.
- S. Sun, A. Tiihonen, F. Oviedo, Z. Liu, J. Thapa, N. T. P. Hartono, A. Goyal, C. Batali, A. Encinas, J. Yoo, R. Li, Z. Ren, M. Bawendi, V. Stevanovic, J. Fisher and T. Buonassisi, "A physical datafusion approach to optimize compositional stability of halide perovskites", *Matter* 4, 1-18 (2021). DOI: 10.1016/j.matt.2021.01.008.
- A. Goyal, P. Gorai, S. Anand, E. S. Toberer, G. J. Snyder and V. Stevanovic, "On the dopability of semiconductors and governing material properties", *Chemistry of Materials* 32, 11, 4467-4480 (2020). DOI:10.1021/acs.chemmater.9b05126.
- L. T. Schelhas, Z. Li, J. A. Christians, A. Goyal, P. Kairys, S. P. Harvey, D. H. Kim, K. H. Stone, J. M. Luther, K. Zhu, V. Stevanovic and J. J. Berry, "Insights into operational stability and processing of halide perovskite active layers", *Energy & Environmental Science* 12 (4), 1341-1348 (2019). DOI:10.1039/C8EE03051K
- A. Goyal, and V. Stevanovic, "Metastable rocksalt ZnO is p- type dopable", *Physical Review Materials* 2, 084603 (2018). DOI:10.1103/PhysRevMaterials.2.084603

AWARDS & RECOGNITIONS

- Key Contributor Award, Materials Physics Group, MCCR Directorate, NREL, 2021
- Research work highlighted at the Center for Next Generation of Materials Design, NREL, 2017
- Best Poster Presentation Award, The Minerals, Metals and Materials Society (TMS), 2015
- Outstanding International Graduate Student Award, University of Florida, 2014
- Awarded Membership, Tau Beta Pi, Engineering Honor Society, 2014
- Awarded Scholarship for MEV Summer School at Oak Ridge National Laboratory, 2012
- Awarded Certificate of Outstanding Achievement, University of Florida, 2011-14 (won 4 times)
- Awarded Graduate Aptitude in Engineering Scholarship at IIT Madras, India, 2009



Dr. Suresh Perumal

Assistant Professor

e-mail: suresh@msme.iith.ac.in

Web: <https://sites.google.com/msme.iith.ac.in/lead-research-group>

RESEARCH INTERESTS

- **Thermoelectric Materials and Devices:** Silicides / Chalcogenides / Oxides / Antimonides.
- **Thermoelectric Metrology:** Design and Fabrication of Thermoelectric Measurement Systems.
- **Magnetic Refrigeration:** Low-field and room-temperature Ni-Mn-based Magnetic Refrigerants.
- **Powder Metallurgy and Materials Processing:** Spark Plasma Sintering / Induction Hot-press and Melt-spun.

RESEARCH PROJECTS

- **Project title:** "Fabrication of Nano-structured MnSi_d/Si based Segmented Thermoelectric Devices: Towards Low-cost and Eco-Friendly Power Generators by recovering waste heat from car exhausters and power plants" sponsored by SERB, Govt. of India. Duration: (2019-2022) Grant: 49.56 Lakhs [Completed]

SELECTED PUBLICATIONS / BOOK

- Ananya Banik, Suresh Perumal, and Kanishka Biswas, Thermoelectric properties of Selected Metal Chalcogenides Nano sheets/Nano films grown by Chemicals and Physical routes, pp. **157-184**, by Springer Nature Publication. (Book title: "Thermoelectric thin films: Materials and Devices")
- Akshara D., Madhuvathani S., Kaushalya K., **Suresh Perumal***, M. S. Ramachandra Rao*, K. Sethupathi*, [Invited Review], J. Phys. D: Appl. Phys., **56**, 333001, **2023**.
- Manojkumar M., Bhuvanesh S., David B., Rajasekar P., **Suresh Perumal***, *ACS Appl. Energy Mater.* **6**, 723-730, **2023**.
- Shaleni V., E Meher Abhinav, N Pavan Kumar, S Kavita, M Manivel Raja, Rajasekar P., Durai Murugan K., **Suresh Perumal***, *ACS Appl. Energy Mater.* **5**, 15959, **2022**.
- Madhuvathani S., Saravanan M., Lokeshwaran R., Animesh B., Reeshma R., Ravikirana, and **Suresh Perumal***, *Mater. Sci. Eng., B.*, **284**, 115912, **2022**.
- Jothilal P., Manojkumar M., Sadhana Katlakunta, **Suresh Perumal***, *Ceram. Int.*, **48**, 29284-29290, **2022**

AWARDS & RECOGNITIONS

- Youth Editorial Board Member in the **Journal of Materiomics**
- Academic Editor in the **Journal of Nanomaterials**
- Guest Editor in **Ceramic International**
- Life membership in the Indian Institute of Metals (IIM)
- Life membership in the Materials Research Society of India (MRSI)
- Life membership in the Indian Ceramic Society (InCerS)
- Life membership in the Electron Microscope Society of India (EMSI)

Distinguished Professors



Prof. P M Ajayan

Distinguished Professor

Rice University, USA

ajayan@rice.edu

Research Interests: Carbon Based Materials, Nanostructured Materials, 2-D layered Materials, Multifunctional Nanocomposite Materials, Additive Manufacturing.



Prof. Chennupati Jagadish

Distinguished Professor,

Australian National University, Australia

chennupati.Jagadish@anu.edu.au

Research Interests: Semiconductor Optoelectronics and Nanotechnology



Prof. Christopher C. Berndt

Distinguished Professor,

Swinburne University of Technology, Australia

cberndt@swin.edu.au

Research Interests: Coatings Technology, Biomaterials such as Orthopaedic Devices, Failure of materials, Thermal Spray, Nanotechnology.

Adjunct Professors



Dr. N R Munirathnam

Adjunct Professor

Former Director General

Centre for Materials for Electronics Technology (C-MET)

rathnam@msme.iith.ac.in

Research Interests: Experimental Matter Physics, Materials Science



Dr. Dheepa Srinivasan

Adjunct Professor

dheepa.srinivasan@msme.iith.ac.in

Research Interests: Materials and Manufacturing Technologies, including advanced characterization and mechanical testing, Additive manufacturing, Thermal spray and Cold spray coatings and Component lifing (including Non-destructive evaluation)



Prof. Banu Sankara Rao

Adjunct Professor

Formerly Pratt & Whitney Chair Professor (UoH); Formerly Ministry of Steel Chair Professor (MGIT); Formerly Professor & Dean, School of Engineering Sciences & Technology (UoH); Formerly Associate Director (IGCAR)

banu@msme.iith.ac.in

Research Interests: Nuclear & Aerospace Materials Development, Mechanical behaviour, Welding Science & Technology



Prof. Tata Narasinga Rao

Adjunct Professor

tata@msme.iith.ac.in

Research Interests: Semiconductor photo-electrochemistry, Photocatalysis, Dye-sensitised & perovskite solar cells, Nanomaterials, Li-ion battery materials and devices, Supercapacitors, Translational materials research.

Technical Staff

Mr. B V Raju

Technical Officer

bvraju.banoth@msme.iith.ac.in

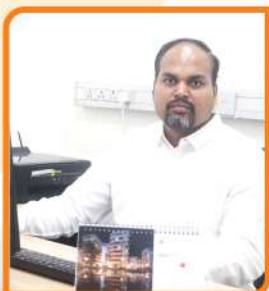
Lab/Facilities Incharge: Structure Materials & Heat Treatment Labs

**Dr. Upender Sunkari**

Technical Officer

upender.sunkari@msme.iith.ac.in

Lab/Facilities Incharge : Electron Microscope & X-Ray Diffraction facilities

**Ms. Yarajani Sravani**

Technical Superintendent

y.sravani@msme.iith.ac.in

Lab/Facilities Incharge: Raman Spectroscopy & Sputtering facilities

**Mr. Laxminarayana Muriki**

Technical Superintendent

m.laxman@msme.iith.ac.in

Lab/Facilities Incharge : Electron Microscopy (TEM, FIB-SEM) facilities

**Mr. Mohammad Abdul Junaid**

Technical Superintendent

junaid.mohammad@msme.iith.ac.in

Lab/Facilities Incharge: Material Simulation lab, Data center/Server operations & Maintenance, High performance computing

**Mr. M V Srinivas**

Technician

mv.srinivas@msme.iith.ac.in

Lab/Facilities Incharge: Optical Microscopy, Micro Hardness, Electro Polishing & Metallography lab facilities



Technical Staff



Mr. E Rangaiah

Technician

rangaiah.e@msme.iith.ac.in

Lab/Facilities Incharge : Sputtering, Raman Spectroscopy & Sensor Material lab

Mr. Nalam Divakar

Junior Technician

divakar.nalam@msme.iith.ac.in

Lab/Facilities Incharge: Powder Metallurgy lab & Mechanical Testing lab



Mr. E R Jothilingam

Junior Technician

jothilingam.er@msme.iith.ac.in

Lab/Facilities Incharge : Functional Properties Characterization facilities

Mr. Asutya Kumar Biswal

Junior Technician

asutya.kumar@msme.iith.ac.in

Lab/Facilities Incharge: Mechanical Testing, Powder Metallurgy & Heavy Duty lab facilities



Ms. Saimatha Gannabathula

Junior Technician

saimatha.g@msme.iith.ac.in

Lab/Facilities Incharge : Microbiology & Cell culture techniques

Administrative Staff



Mr. Harish Ramaneni
Executive Assistant
harish.ramineni@admin.iith.ac.in

Mr. Cheemakurthi M Subhani
Multi Skill Assistant Gr-I (General)
subhani.m@admin.iith.ac.in

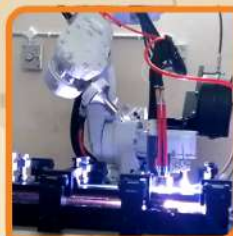


Inauguration of MSME Department Building

RESEARCH FACILITIES

Synthesis & Processing Instruments

- Physical vapour deposition
- Chemical vapour deposition
- Pulsed laser deposition
- Electron beam deposition
- Magnetron sputtering
- Planetary Bball mill
- Rolling mill
- Refrigerated centrifuge
- Cold isostatic press
- Freeze drier
- Uniaxial compaction press
- Electrochemical analyser
- Robotic welding



Microstructure & Mechanical Analysis

- TEM
- SEM
- Upright microscope
- Nanoindentor
- PIPS
- Universal testing machine - MTS, Instron
- Hardness tester
- Impact testing machine



Functional Properties Characterization

- XRD
- Thin film XRD
- BET
- Physical property measurement system
- Confocal Raman
- UV -visible spectrometer
- Atommmics force microscope
- Impedance Analyzer
- Potentiostat
- Bio safety cabinet
- Incubator shaker
- High resolution spectroscopy
- Viscometer

Furnaces

- Induction melting furnace
- High temperature furnace
- Infra - red rapid heating furnace
- Muffle furnace
- salt bath furnace
- Auto clave
- Tube furnace

Computational

- Thermocalc
- DICTRA
- TC-Prisma

RESEARCH FACILITIES



JEOL JIB 4700 FIB-SEM

Multibeam (Schottky electron gun & Ga ion source) system with EDS & EBSD can be used in morphological observations & crystallographic analysis.

Ga ion beam with 90 nA enables fast ion milling & processing of specimens.

RESEARCH FACILITIES



JEOL JEM 2100

Transmission electron microscope with LaB6 electron gun equipped with EDS & STEM Detectors



JEOL JEM F200

Transmission electron microscope with cold-FEG equipped with EDS & STEM Detectors

RESEARCH FACILITIES



PULSED LASER DEPOSITION

Thin film & epitaxial thin films deposition of oxide functional materials



NANOINDENTOR

Ability to measure hardness of a nano range particles in a bulk material.

RESEARCH FACILITIES



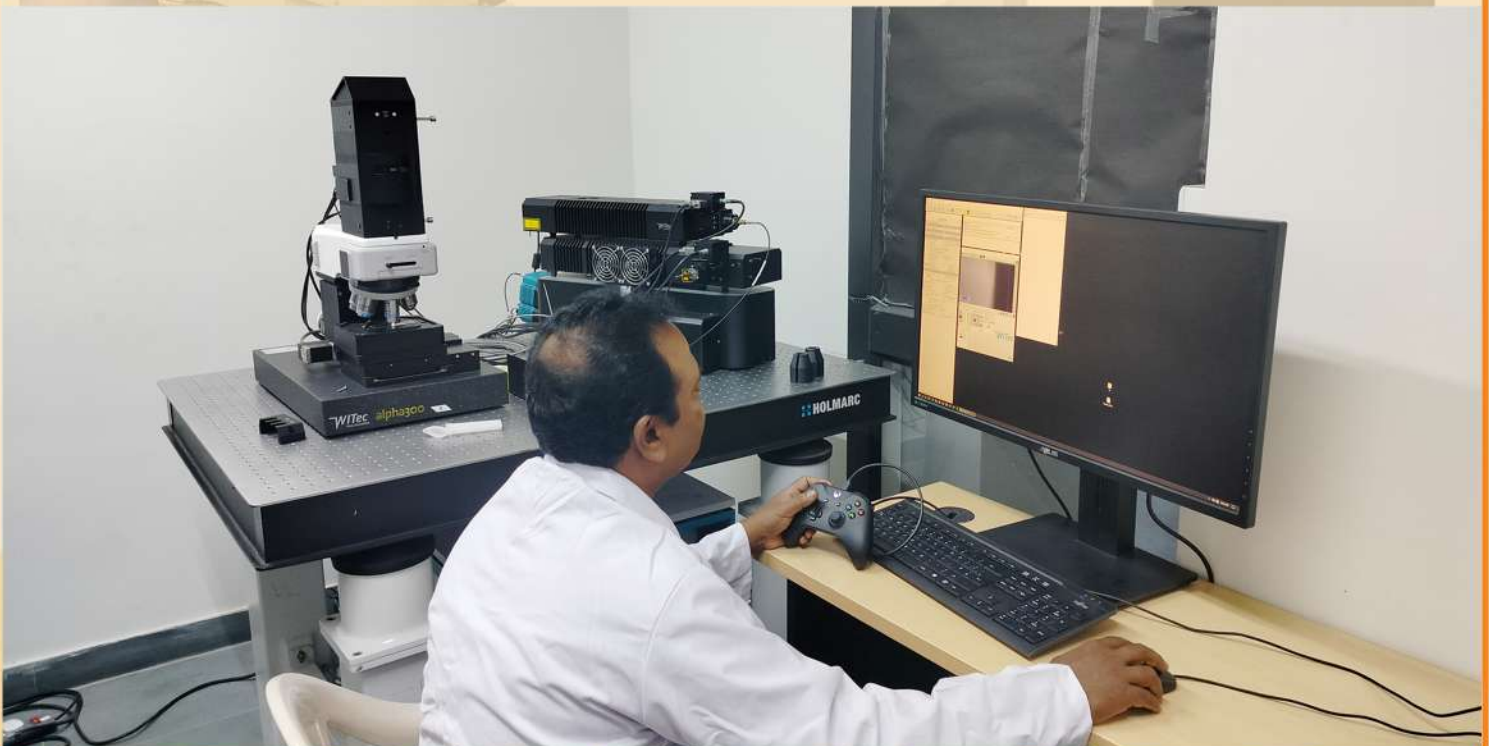
PHYSICAL PROPERTY MEASUREMENT SYSTEM

VSM, ETO & Heat Capacity at cryogenic



ATOMIC FORCE MICROSCOPY

PFM, MFM, SCM, STM & SSRM



RAMAN SPECTROSCOPY : Ultra-fast Raman imaging option with under one millisecond integration time per spectrum, Ultra-high throughput spectroscopic system for highest sensitivity and best performance in spectral resolution

RESEARCH FACILITIES



THIN FILM XRD

GIXRD, HRXRD, RSM, XRR, & COUPLED 2θ - ω

RESEARCH FACILITIES



BULK & POWDER XRD

Multipurpose X-ray diffraction (XRD) system for analysis of powders solids and thin film specimens

RESEARCH FACILITIES



INSTRON UNIVERSAL TESTING MACHINE

screw driven testing machine equipped with 30kN and 5kN load cells along with high temperature and DIC to measure strain set up

Areas of Research

Materials Processing

Faculty Involved	Topics of Research
Prof. B S Murty	<ul style="list-style-type: none"> Materials Processing and Microstructure
Prof. Pinaki Prasad Bhattacharjee	<ul style="list-style-type: none"> Thermo-mechanical Processing Solid-state Additive Manufacturing
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none"> Combinatorial Materials Engineering Electrochemical coatings Electrochemical Additive Manufacturing
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none"> Powder Metallurgy Sintering Powder Manufacturing Heat Treatments Toughening of Steels Grain boundary Engineering of Steels
Dr. Subhradeep Chatterjee	<ul style="list-style-type: none"> Welding and Additive Manufacturing
Dr. Rajesh Korla	<ul style="list-style-type: none"> Development of Cu-Cr-Nb-Zr alloy for thrust chamber applications., Effect of Mo in the high temperature behavior of Fe-Mn-Al-C austenitic light weight steel
Dr. Chandrasekhar Murapaka	<ul style="list-style-type: none"> Thin film deposition using Magnetron sputtering for magnetic/non-magnetic heterostructures
Dr. Suresh Kumar Garlapati	<ul style="list-style-type: none"> Deposition of thin films of thin films (oxide semiconductors organic semiconductors, metal electrodes, oxide dielectrics) using solution processes such as spin coating and inkjet printing.
Dr. Ashok Kamaraj	<ul style="list-style-type: none"> Design and development of alloy steels Inclusion engineering in steels continuous casting of liquid steels
Dr. Suresh Perumal	<ul style="list-style-type: none"> Induction hot-press Spark Plasma Sintering High energy ball milling and Melt-Spun

Areas of Research

High Entropy Alloys and Advanced Metallic Materials

Faculty Involved	Topics of Research
Prof. B S Murty	<ul style="list-style-type: none">▪ High Entropy Alloys & Materials
Prof. Pinaki Prasad Bhattacharjee	<ul style="list-style-type: none">▪ Thermo-mechanical Processing▪ Solid-state Additive Manufacturing
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Combinatorial Materials Engineering▪ Electrochemical coatings.▪ Electrochemical Additive Manufacturing
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">▪ PM processing of High entropy alloys and high entropy carbides, Steels▪ Titanium alloys, Inconel Superalloys
Dr. Subhradeep Chatterjee	<ul style="list-style-type: none">▪ Welding and Additive Manufacturing
Dr. Rajesh Korla	<ul style="list-style-type: none">▪ Design and development of high entropy alloys for high temperature applications
Dr. Chandrasekhar Murapaka	<ul style="list-style-type: none">▪ Thin film deposition using Magnetron sputtering for magnetic/non-magnetic heterostructures
Dr. Ashok Kamaraj	<ul style="list-style-type: none">▪ Design and development of alloy steels, Inclusion engineering in steels▪ continuous casting of liquid steels
Dr. Suresh Perumal	<ul style="list-style-type: none">▪ Induction hot-press▪ Spark Plasma Sintering▪ High energy ball milling and Melt-Spun

Areas of Research

Functional Materials

Faculty Involved	Topics of Research
Prof. B S Murty	<ul style="list-style-type: none">▪ Multi-Functional Materials
Prof. Pinaki Prasad Bhattacharjee	<ul style="list-style-type: none">▪ Thermo-mechanical Processing▪ Solid-state Additive Manufacturing
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Combinatorial Materials Engineering▪ Electrochemical coatings▪ Electrochemical Additive Manufacturing
Dr. Subhradeep Chatterjee	<ul style="list-style-type: none">▪ Welding and Additive Manufacturing
Dr. Shourya Dutta Gupta	<ul style="list-style-type: none">▪ Plasmonics▪ Alloy thin films▪ in-situ optical spectroscopy▪ Raman spectroscopy▪ Nanofabrication▪ Optical sensors▪ Optical modulators▪ Microfluidics
Dr. Chandrasekhar Murapaka	<ul style="list-style-type: none">▪ Thin film deposition using Magnetron sputtering for magnetic/non-magnetic heterostructures
Dr. Suresh Kumar Garlapati	<ul style="list-style-type: none">▪ Deposition of thin films of thin films (oxide semiconductors, organic semiconductors, metal electrodes, oxide dielectrics) using solution processes such as spin coating and inkjet printing.
Dr. Suresh Perumal	<ul style="list-style-type: none">▪ Thermoelectric Materials▪ Magnetic Refrigeration▪ Supercapacitors
Dr. Anuj Goyal	<ul style="list-style-type: none">▪ Power electronics▪ wide band gap semiconductors▪ Quantum information science

Areas of Research

Advanced Materials Characterization

Faculty Involved	Topics of Research
Prof. Pinaki Prasad Bhattacharjee	<ul style="list-style-type: none">▪ Electron Backscatter Diffraction studies▪ TEM studies▪ Mechanical Behavior of Materials
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Correlative characterization-based materials investigations.▪ Structural-microstructural integrity studies of small-scale metallic architectures
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">▪ DSC▪ TGA▪ Dilatometer
Dr. Shourya Dutta Gupta	<ul style="list-style-type: none">▪ Plasmonics▪ Alloy thin films▪ in-situ optical spectroscopy▪ Raman spectroscopy▪ Nanofabrication▪ Optical sensors▪ Optical modulators▪ Microfluidics
Dr. Mayur Vaidya	<ul style="list-style-type: none">▪ Structure-property correlation in multicomponent alloys
Dr. Chandrasekhar Murapaka	<ul style="list-style-type: none">▪ Magnetic domain imaging using MOKE and MFM and Magnetization dynamics studies using FMR
Dr. Ashok Kamaraj	<ul style="list-style-type: none">▪ Inclusions characterization in steel products using advanced techniques.▪ Inclusion rating in steel products▪ Volume defect characterization in 3D printed materials
Dr. Suresh Perumal	<ul style="list-style-type: none">▪ Temperature-dependent transport (Electrical, thermal and magnetic) property measurements

Areas of Research

Electrochemical Materials Engineering

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Electrochemical fabrication of multidimensional (0D, 1D, 2D and 3D) multicomponent alloy (up to five elements) nanoarchitectures.▪ Corrosion Studies
Dr. Mayur Vaidya	<ul style="list-style-type: none">▪ Oxidation behavior of multicomponent alloys

Computational Materials Engineering

Faculty Involved	Topics of Research
Dr. Ashok Kamaraj	<ul style="list-style-type: none">▪ Physical and thermochemical modeling of metallurgical processes
Dr. Anuj Goyal	<ul style="list-style-type: none">▪ Defect Engineering▪ Doping of semiconductors▪ Thermodynamic modeling of point defects

Health care & Bio-Materials

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Antiviral/microbial coatings on any substrates▪ Design of metal/alloy nanowires-based bio inks for biomedical applications (tissue engineering)▪ Bio-alloy design (joint replacements)
Prof Ranjith Ramadurai	<ul style="list-style-type: none">▪ Biomedical Materials
Dr. Mudrika Khandelwal	<ul style="list-style-type: none">▪ Drug Delivery▪ Antimicrobial Materials
Dr. Suresh Kumar Garlapati	<ul style="list-style-type: none">▪ Sensors for healthcare applications

Areas of Research

Sustainable Metallurgy

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">Recovery of critical materials from E-wastes (LiBs, Solar PVs)/Mining tailings
Dr. Ashok Kamaraj	<ul style="list-style-type: none">Metal extraction & recycling through sustainable techniquesGreen Steelmaking (incl. Hydrogen metallurgy)Clean steel practicesHot slag engineeringLife cycle & sustainability analysis of metallurgical processes

Corrosion

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">Corrosion studies of metals/alloys
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">Corrosion studies on HEAs, Steels, additively manufactured alloys (Inconel, Al-alloys)

Areas of Research

Nanoscience & Nanotechnology

Faculty Involved	Topics of Research
Prof B S Murty	▪ Nanoscience and Technology
Prof. Pinaki Prasad Bhattacharjee	▪ Bulk Nanostructured Materials
Prof. Suhash Ranjan Dey	▪ Substrate-supported nano-catalysts design for various applications (HER, OER, CO ₂ reduction)
Prof Ranjith Ramadurai	▪ Smart Materials & Devices
Prof. Bharat Bhooshan Panigrahi	▪ Nanocrystalline alloys ▪ HEA ▪ Mechanical alloying
Dr. Atul Deshpande	▪ High entropy oxide nanoparticle synthesis for catalysis ▪ high thermal stability and energy storage applications
Dr. Shourya Dutta Gupta	▪ Plasmonics ▪ Alloy thin films ▪ in-situ optical spectroscopy ▪ Raman spectroscopy ▪ Nanofabrication ▪ Optical sensors ▪ Optical modulators ▪ Microfluidics
Dr. Chandrasekhar Murapaka	▪ Development of spintronic based nanodevices for memory and logic applications
Dr. Suresh Kumar Garlapati	▪ Thin film transistors and memristor devices
Dr. Suresh Perumal	▪ Thermoelectric Materials ▪ Magnetic Refrigeration ▪ Supercapacitors

Areas of Research

Energy Materials

Faculty Involved	Topics of Research
Prof. B S Murty	▪ Energy storage materials
Prof. Bharat Bhooshan Panigrahi	▪ 2D MXenes for Energy storage and supercapacitors
Dr. Mudrika Khandelwal	▪ Anode for Batteries ▪ Flexible Electronics
Dr. Anuj Goyal	▪ Materials for Solar Thermochemical Hydrogen ▪ Doping of Thermoelectric Materials
Dr. Suresh Perumal	▪ Thermoelectric Materials ▪ Magnetic Refrigeration ▪ Supercapacitors

Thin Films

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	▪ Electrochemical/Electroless Coatings
Prof. Ranjith Ramadurai	▪ Multifunctional thin films
Dr. Shourya Dutta Gupta	▪ Plasmonics ▪ Alloy thin films ▪ in-situ optical spectroscopy ▪ Raman spectroscopy ▪ Nanofabrication ▪ Optical sensors ▪ Optical modulators
Dr. Chandrasekhar Murapaka	▪ PVD
Dr. Deepu J. Babu	▪ CVD
Dr. Suresh K. Garlapati	▪ Printed electronics

Areas of Research

Computational Materials Science

Faculty Involved	Topics of Research
Dr. Saswata Bhattacharya & Dr. Anuj Goyal	<ul style="list-style-type: none">▪ Electronic structure modeling and atomistic modeling methods▪ Machine learning approaches for defect modeling

Additive Manufacturing

Faculty Involved	Topics of Research
Prof. B S Murty	<ul style="list-style-type: none">▪ Additive Manufacturing
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Additive Manufacturing of PH 15-5, NiTi
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">▪ Additive Manufacturing of Superalloys IN718, IN625

Advanced Ceramics and Composites

Faculty Involved	Topics of Research
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">▪ Continuous fiber reinforced ceramic matrix composites for ultra-high temperature

Coating and Surface Engineering

Faculty Involved	Topics of Research
Prof. Suhash Ranjan Dey	<ul style="list-style-type: none">▪ Electrochemical plating/coating▪ Anodization
Prof. Bharat Bhooshan Panigrahi	<ul style="list-style-type: none">▪ Electro-spark Coating,▪ Wear and Tribology

List of Projects

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
1.	Suhash Ranjan Dey	Synthesis and characterization of nanocrystalline metals through pulsed electrodeposition	2010-2013	IIT Hyderabad Seed Grant	5 lakhs	PI
2.	Pinaki Prasad Bhattacharjee	Effect of static recovery on yielding and work-hardening behavior of bulk nanostructured Al-Mg-Sc/Zr alloys	2011-13	DST-JSPS	3 lakhs	PI
3.	Suhash Ranjan Dey	Combinatorial design of nanostructured novel alloys through pulsed electrodeposition	2012-2015	CSIR	7.5 lakhs	PI
4.	Suhash Ranjan Dey	Feasibility studies on joining austenitic stainless steel with other application-based alloys using friction stir welding process	2012-2015	BRNS-DAE	13.65 lakhs	PI
5.	Pinaki Prasad Bhattacharjee	Continuous recrystallization and evolution of mechanical properties in bulk ultrafine grained aluminum alloys	2012-15 (completed)	DST Fast Track	23.69 lakhs	PI
6.	Pinaki Prasad Bhattacharjee	Evolution of nanostructure and mechanical properties during severe plastic deformation of materials: Critical evaluation of the role of solution hardening and stacking fault energy	2012-15 (completed)	CSIR	18.77	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
7.	Suhash Ranjan Dey	Feasibility studies of joining titanium aluminides through friction stir welding	2013-2016	DST (Fast Track Scheme for Young Scientists)	18.2 lakhs	PI
8.	Pinaki Prasad Bhattacharjee	Development of bulk nanostructured multicomponent high entropy alloys for advanced structural applications	2013-16 (Completed)	SERB	16.68	PI
9.	Bharat B. Panigrahi	Synthesis and sintering of ultrafine grained MAX phase compounds	2013-2016	SERB	52.4	PI
10.	Bharat B. Panigrahi	Rolling of Ti ₃ AlC ₂ Ceramic	2013-2015	Seed grant, IITH	7.5	PI
11.	Suhash Ranjan Dey	Development of novel high strength harmonic Ti-Nb-Sn compositions for biomedical applications	2014-2016	DST-JSPS S&T	12.32 lakhs	PI
12.	Saswata Bhattacharya	Dislocation Dynamics based studies in Particle Strengthened Alloy Systems	2014-2016	GE	14 Lakhs	PI
13.	Pinaki Prasad Bhattacharjee	Recrystallization behavior and evolution of microstructure and mechanical properties in bulk nanostructured duplex steels processed by severe plastic deformation"	2014-17 (Completed)	DRDO(ER&IPR)	71.85	PI
14.	Saswata Bhattacharya	Phase field modeling of eutectoid transformation in steel	2015-2016	TATA STEEL	13 Lakhs	PI
15.	Suhash Ranjan Dey	Role of Aluminium addition in high strength interstitial free (IFHS) steel	2016-2019	TATA Steel	33.12 lakhs	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
16.	Suhash Ranjan Dey	Synthesis and characterization of novel Ni-Cu-Graphene thin film libraries using combinatorial approach by electrodeposition	2016-2018	DST SERB (NPDF)	19.2 lakhs	PI
17.	Suhash Ranjan Dey	Enhancement of efficiency through modification of CIGS absorber layer by non-vacuum route for solar cell application	2016-2021	DST INSPIRE Fellowship for Ph.D.	21.9 lakhs	PI
18.	Subhradeep Chatterjee	Design, Manufacturing and Microstructural Analysis of Novel Hard Coatings on Titanium Produced by Weld Deposition Techniques	2016-2019	SERB	44 lakhs	PI
19.	Saswata Bhattacharya	Development of modeling techniques (Atomistic Monte Carlo and Phase-field simulations) to understand metallurgical phenomena in advanced high strength steels	2016-2019	TATA STEEL	30 Lakhs	PI
20.	Pinaki Prasad Bhattacharjee	Challenging the strength-ductility paradox in materials	2016-19 (Completed)	JICA-CKP	52	PI
21.	Rajesh Korla	Investigating the possibility of superplasticity in High entropy AlCoCrFeNi dual phase alloy at high temperature.	2016-2018	Seed grant	3	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
22.	Saswata Bhattacharya	Computational Microstructural Design of P/M Disk Superalloys using Phase Field Modeling towards Accelerated Alloy Design	2017-2020	DMRL (DRDO)	34 Lakhs	PI
23.	Saswata Bhattacharya	Accelerated Alloy Design and Processing Optimization Using Computational Thermodynamics and Kinetics - Based Tools	2017-2020	MIDHANI	63 Lakhs	PI
24.	Saswata Bhattacharya	"Effect of Electromechanical Forces on Domain Evolution in Ferroelectric and Multiferroic Thin Films: Phase-Field Modeling and Simulations	2017-2020	DST - SERB	54.84 Lakhs	PI
25.	Pinaki Prasad Bhattacharjee	Development of a Novel AlCoCrFeNi _{2.1} Eutectic High Entropy Alloy Using Thermo-Mechanical Processing	2017-2020 (Completed)	SERB	48	PI
26.	Pinaki Prasad Bhattacharjee	Scanning Electron Microscope Facility	2017	DST	275	PI
27.	Shourya Dutta Gupta	Assembly of gold nanoparticles using templated silica platforms	2017-2019	Seed Grant, IIT Hyderabad	3	PI
28.	Rajesh Korla	Evaluation of creep behavior of AlCoCrFeNiMo _{0.5} high strength high entropy alloy	2017-2019	SERB-ECR	51.97	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
29.	Chandrasekhar Murapaka	"Spin-orbit torque induced magnetization dynamics in perpendicular magnetic anisotropy materials for non-volatile memory and logic applications	2018-2023	SERB-ECR	49.96 Lakhs	PI
30.	Shourya Dutta Gupta	On-demand real time ultra-sensitive cytokine profiling with integrated nano-plasmonic platform	2018-2023	Ramanujan Fellowship, SERB	38	PI
31.	Pinaki Prasad Bhattacharjee	Development of High Entropy Alloys with Outstanding Strength-Ductility for various Applications	2018-2020 (Completed)	TATA Steel	12.84	PI
32.	Suhash Ranjan Dey	Tuning the magnetic properties of nanocrystalline multi-component alloy thin film coatings through a single step electrodeposition for sensor applications	2019-2023	"MHRD-SPARC (IIT Hyderabad, INDIA-Shanghai Jiao Tong University, PR CHINA)"	50 lakhs	PI
33.	Shourya Dutta Gupta	Simultaneous monitoring of multiple cytokines via SERS signals using critically coupled optical perfect absorber sensor substrates	2019-2022	DST-Nanomission	47.44	PI
34.	Shourya Dutta Gupta	Spinodal decomposition in Cu-Ag alloy thin films: A route to tunable plasmonics	2019-2022	SERB - ECR	49.7	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
35.	Chandrasekhar Murapaka	Fabrication of compositionally and geometrically modulated cylindrical ferromagnetic nanowires for magnetic nanobarcode applications	2019-2021	IIT Hyderabad Seed Grant	3 Lakhs	PI
36.	Suhash Ranjan Dey	Microstructural evolution and structure-property correlations in FeCoNi based multi component alloy thin films	2020-2023	Indo-Sweden DST-VR	43.68 lakhs	PI
37.	Suhash Ranjan Dey	Anti-viral coatings of electrochemically reduced metal nanoparticles for respirators	2020-2022	Interdisciplinary Project, IIT Hyderabad	10 lakhs	PI
38.	Suhash Ranjan Dey	Cobalt nanowire-PEG fortified hydrogels to stimulate stem cells magnetically and deliver drugs locally for osteoarthritis patients	2020-2022	Interdisciplinary Project, IIT Hyderabad	10 lakhs	Co-PI
39.	Pinaki Prasad Bhattacharjee	Tuning heterogeneous nanostructure via strain-partition engineering for developing cobalt-free cost-effective eutectic high entropy alloys with outstanding strength-ductility synergy	2020-2023 (Completed)	SERB	26	PI
40.	Pinaki Prasad Bhattacharjee	Development of High Entropy Alloys with Multiscale Heterogeneities	2020-2023 (Completed)	DRDO(ER&IPR)	72	PI
41.	Bharat B. Panigrahi	Post-Processing of Direct Energy	2020-2023	SERB CRG	43.48	PI

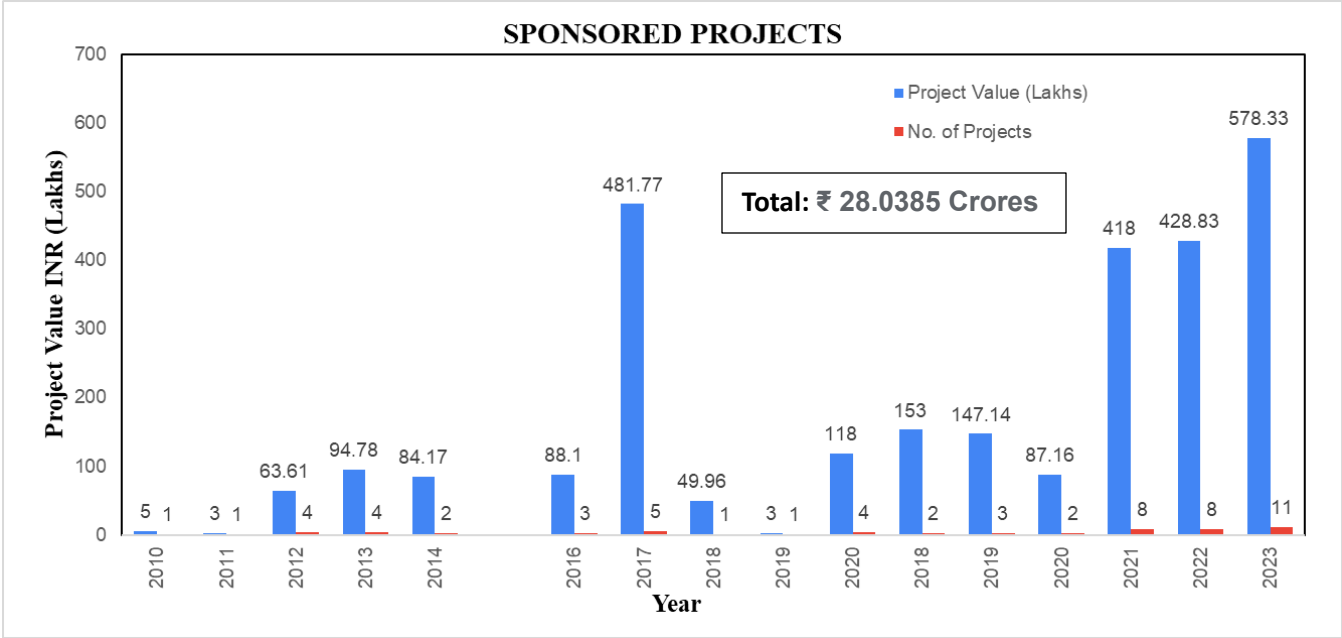
S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
		Deposition Components: Need Identification and Process Selection				
42.	Suhash Ranjan Dey	Startup Grant on Deep Technology	2021-2023	NMDC and i-TIC Foundation (IIT Hyderabad)	25 lakhs	Co-Director
43.	Saswata Bhattacharya	Repository of high-performance phase field solvers for Microstructure Simulations (MicroSim) - Phase I	2021-2023	DST-NSM	20.48 Lakhs	PI
44.	Suresh Kumar Garlapati	Completely printed/solution processed, transparent, and flexible metal oxide memristors at or near room temperature	2021-2023	Seed grant, IITH	25 lakhs	PI
45.	Suresh Kumar Garlapati	A general route towards low voltage, high-current power printed electronics	2021-2023	SERB SRG	30 lakhs	PI
46.	Deepu J. Babu	Graphdiyne membranes for gas separation applications	2021-2023	Seed grant, IITH	25	PI
47.	Pinaki Prasad Bhattacharjee	"Investigating the evolution of heterogeneous microstructure in metallic alloys by thermomechanical processing using correlative FIB-SEM and in-situ TEM techniques".	2021-24 (Ongoing)	DRDO(ER&IPR)	92	Co-PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
48.	Pinaki Prasad Bhattacharjee	Tuning crystalline-amorphous band heterogeneous nanostructure in extremely low stacking fault energy high entropy alloys for simultaneous enhancement of strength and ductility	2021-24 (Ongoing)	SERB-STAR	38.69	PI
49.	Bharat B. Panigrahi	Development of fibers reinforced alumina and zirconia matrix composites for high temperature applications	2021-2024	DRDO	118.2	PI
50.	Rajesh Korla	Investigation of the high temperature deformation and creep behavior of Fe-Mn-Al-C low density steels	2021-2024	SERB-CRG	43.7	PI
51.	Ashok	Reductive/Direct Alloying Technique for Making Lightweight (low-density) Steel	2022-2024	IIT Hyderabad Seed Grant	30 lakhs	PI
52.	Deepu J. Babu	O ₂ /N ₂ separation with nanoporous materials by hindering lattice flexibility in MOFs	2022-2023	SRG, SERB	31.7 Lakhs	PI
53.	Shourya Dutta Gupta	Multi-axial strain sensing using photonic crystal rubber	Apr-Nov 2022	JICA Phase 2 Project (JICA)	7.94	PI
54.	Saswata Bhattacharya	Assessment of high-fidelity diffusion coefficients in ternary and multicomponent Ni-Al-X (X=Mo, Ta,	2022-2024	DST-SERB (CRG)	49.72 Lakhs	PI

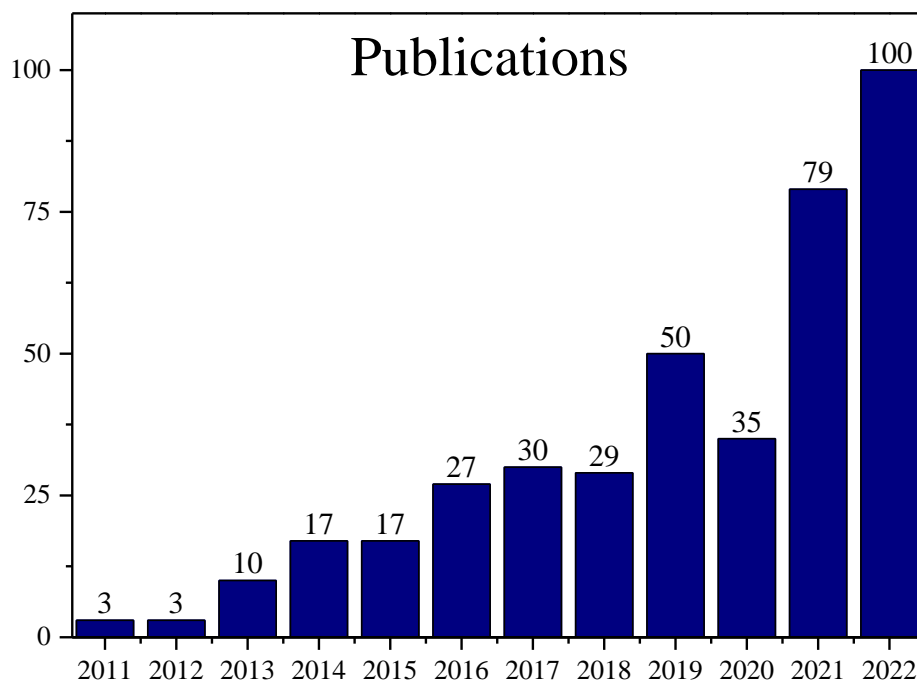
S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
		Re, W) alloys and their effect on Ostwald ripening				
55.	Saswata Bhattacharya	Through-process modeling of DS/SC superalloy turbine blades processed using modified Bridgman route – Validation with CMSX-4 alloy	2022-2026	ARDB (GTMAP)	107 Lakhs	PI
56.	Chandrasekhar Murapaka	Harnessing pure spin current by tailoring molecular spinterface	2022-2025	BRNS-DAE	30.03 Lakhs	PI
57.	Pinaki Prasad Bhattacharjee	Borated Steels	2022-23 (Ongoing)	Prasadiya Group	22	PI
58.	Bharat B. Panigrahi	High entropy carbide based cutting tool inserts	2022-2025	SUPRA SERB	30.94 lakhs	PI
59.	Shourya Dutta Gupta	Development of 3D-bioprinted artificial pancreas with nanosensors for real-time monitored insulin release: In vitro model replacing animal models for diabetic treatment	2022-2024	IIT Hyderabad (SOCH Grant)	99.44	Co-PI
60.	Ashok	Mineralogical and Microstructural studies on high alumina iron	2023-2024	Tata Steel Ltd Jamshedpur	30.94 lakhs	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
		ore fines and their influence on pelletizing				
61.	Saswata Bhattacharya	Repository of high-performance phase field solvers for Microstructure Simulations (MicroSim) Phase II	2023-2024	DST-NSM	15 Lakhs	PI
62.	Saswata Bhattacharya	Computational Approach Using Machine Learning, CALPHAD and First Principles Calculations for Accelerated Development of Complex Concentrated Alloys	2023-2024	DMRL (DRDO)	29.9 Lakhs	PI
63.	Rajesh Korla	Near net shape manufacturing of grain-oriented transformer grade electrical steel	2023-2025	DST	55.6	Co-PI
64.	Saswata Bhattacharya	Process Modelling of the manufacturing processes leading to turbine blades of single crystal nickel base superalloys and titanium alloy components	2023-2027	DRDO DIA-RCOE IISc	134 Lakhs	PI
65.	Deepu J. Babu	Post-synthetic modification of porous organic polymers for improved CO2 capture and its utilization for the synthesis of acrylic acid and its derivatives	2023 - 2026	STARS, DST	60	Co-PI
66.	Chandrasekhar Murapaka	Ferrimagnet based synaptic device for	2023-2026	SERB-CRG	64.83 Lakhs	PI

S.No	Faculty Name	Project Title	Duration	Agency	Amount (INR)	PI/CO-PI
		neuromorphic computing				
67.	Chandrasekhar Murapaka	Novel spin Hall materials for spin-orbit torque based memory and logic devices	2023-2025	JICA Friendship 2.0	20 Lakhs	PI
68.	Chandrasekhar Murapaka	Spintronics based Digital Logic Architecture Design for AI Applications	2023-2026	SERB-CRG	60 Lakhs	Co-PI
69.	Suresh Kumar Garlapati	Development of a complete authentication system using printed RRAM based PUFs,	2023-2025	IHUB NTIHAC Foundation IIT Kanpur	20 lakhs	Co-PI
70.	Suresh Kumar Garlapati	Printed, wearable sensor array for non-invasive monitoring of diabetic complications and chronic kidney diseases	2023-2026	MHRD STARS	65 lakhs	PI
71.	Pinaki Prasad Bhattacharjee	Development of Novel Eutectic High Entropy Alloys	2023-25 (Ongoing)	SPARC	36	Indian PI
72.	Anuj Goyal	Developing a Computational Approach to Accelerate Point Defects Characterization in Materials	2023-2025	Seed grant, IITH	18 lakhs	PI
73.	Shourya Dutta Gupta	Assembly of gold nanoparticles using silica templated platforms	2017-2019	Seed Grant, IIT Hyderabad	3	PI



Publications



The faculty of the MSME Department published their research articles in reputed international journals such as Nature Communications, Small, ACS Applied Materials and Interfaces, Materials Research Letters, Scripta Materialia, Acta Materialia, and Electrochimica Acta among others.

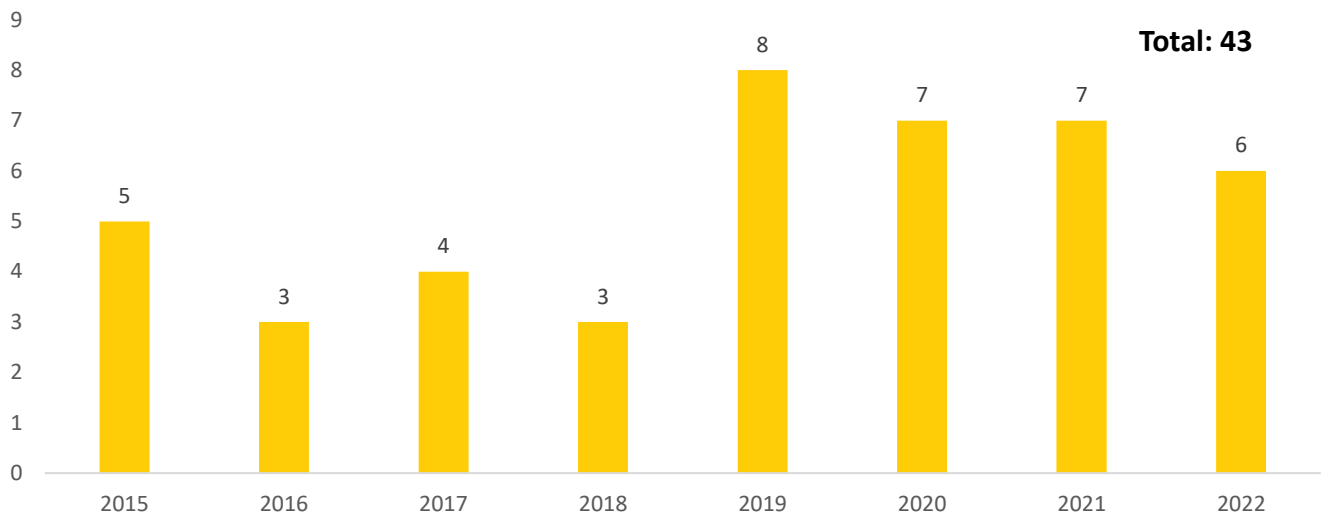
List of Patents

S.No	Patent Details	Year	Grant/Filed	Faculty Name
1.	Method for Extraction of water soluble eggshell membrane protein, Authors: M. K. Sah, U. K. Roopavath, S. N. Rath, B. B. Panigrahi, Application No.: 201731017393 (2017, India). Dt filed: 18/05/2017	2017	Filed	Prof. Bharat Bhooshan Panigrahi
2.	Single step electrochemical synthesis of nanocrystalline multicomponent alloy thin films/coatings in an aqueous medium, Chokkakula L.P. Pavithra, Kunda Siri Kiran Janardhana Reddy and Suhash Ranjan Dey, Indian Patent, Patent Application No. 201941013178 (Filed). First Examination Report submitted	2019	Filed	Prof. Suhash R. Dey
3.	High entropy alloy and quinary alloy nanowires. Chokkakula L.P. Pavithra, Suhash Ranjan Dey and Kunda Siri Kiran Janardhana Reddy, Indian Patent, Patent of Addition to 20194103178, Application No. 202043041990.	2020	Filed	Prof. Suhash R. Dey
4.	Indian Patent Application No. 202041050666: Ferroelectric Polymer (B-PVDF) For Control and Mitigation of Microbes Under Small Voltage Signals	2020	Filed	Prof. Ranjith Ramadurai
5.	Indian Patent Application No. 202041053912"A Device Configurable in a Microscope for Real Time Testing and Imaging of A Sample"	2020	Filed	Prof. Ranjith Ramadurai
6.	Domain wall tunnelling and logic operations in ferromagnetic nanostructures", Surya Jammalamadaka, Chandrasekhar Murapaka and Sreeveni MD, Indian Patent (201941048936) (Filed) (2020).	2020	Filed	Dr. Chandrasekhar Murapaka
7.	Reconfigurable logic via gate controlled skyrmion motion", B Paikaray, K. Mahathi, A Haldar, Chandrasekhar Murapaka, Indian Patent (202141057701) (Filed) (2021).	2021	Filed	Dr. Chandrasekhar Murapaka
8.	NiFe/FeMn exchange biased systems for bias field-free magnetization dynamics", B. Panigrahi, A. Haldar, Chandrasekhar Murapaka Indian patent (202241051146) (filed) (2022).	2022	Filed	Dr. Chandrasekhar Murapaka
9.	Skyrmion based majority logic gate in nanomagnetic device", B Paikaray, K. Mahathi, A Haldar, Chandrasekhar Murapaka, Indian Patent (202241010372) (Filed) (2022).	2022	Granted	Dr. Chandrasekhar Murapaka

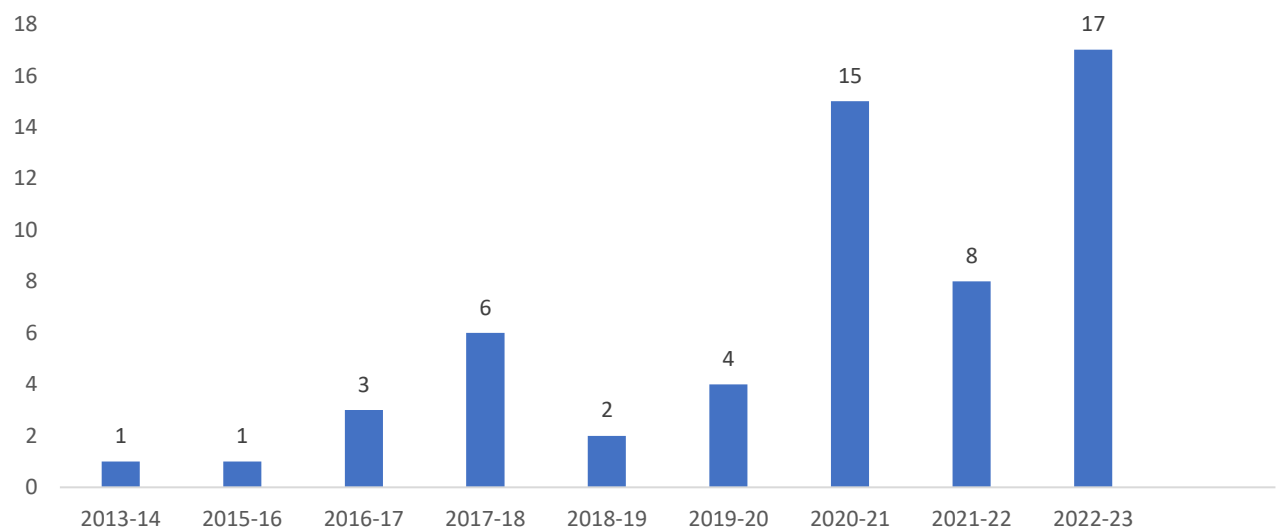
Books/Books Chapter Details

S.No	Book/Book Chapter Details	Faculty Name
1.	"Pulsed electrochemical deposition of CuInSe ₂ and Cu(In,Ga)Se ₂ semiconductor thin films. (Book Chapter) Sreekanth Mandati, Bulusu V. Sarada, Suhash Ranjan Dey and Shrikant V. Joshi, Semiconductors-Growth and Characterization, Intechopen, 2017, ISBN 978-953-51-5589-8."	Prof. Suhash R. Dey
2.	Chapter 10-"Piezoelectrics and multifunctional composites" – Dr. Ranjith Ramdurai and Dr. Vijaynandhini Kannan – "in a book titled "Perovskites and Related Mixed Oxides" Ed. By P. Granger, V.I. Parvulescu, S. Kaliaguine and W. Prellier – Volume I, Wiley-VCH, (2015).	Prof. Ranjith Ramdurai
3.	Magnetic domain walls for memory and logic applications", Chandrasekhar Murapaka, Indra Purnama and Wen Siang Lew, "Advances in Magnetic Materials: Processing, Properties and Performance", CRC Press (2017).	Dr. Chandrasekhar Murapaka
4.	Chapter Title: – "Multiferroics – Perspectives on Strain Structure and Properties" – Dr. Ranjith Ramadurai and Saj Mohan MM – in a book titled "Advances in Highly Correlated Systems" – River publishers – in press. (Oct 2020)	Prof. Ranjith Ramadurai
5.	"Strain Engineering in Functional Materials and Devices, Edited by: Ranjith Ramadurai and Saswata Bhattacharyya, AIP Publishing LLC, DOI:10.1063/9780735425590,ISBN electronic: 978-0-7354-2559-0, ISBN print: 978-0-7354-2556-9, Publication date: 2023"	Prof. Ranjith Ramadurai & Dr. Saswata Bhattacharya
6.	"Strain engineering in crystalline solids in Strain Engineering in Functional Materials and Devices, edited by R. Ramadurai and S. Bhattacharyya (AIP Publishing, Melville, New York, 2023), pp. 1-1-1-22."	Prof. Ranjith Ramadurai & Dr. Saswata Bhattacharya
7.	"Phase-field modeling of ferroic domains in strained structures in Strain Engineering in Functional Materials and Devices, edited by R. Ramadurai and S. Bhattacharyya (AIP Publishing, Melville, New York, 2023), pp. 6-1-6-28."	Dr. Saswata Bhattacharya & Dr. Soumya Bandyopadhyay
8.	Book - Strain Engineering in Functional Materials – Edited by Ranjith Ramadurai (RR) and Saswata Battacharya (SB)- AIP publishers (American Institute of Physics) – Expected to complete by Feb 2022. (includes two individual chapters from RR and one co-authored with SB)	Prof. Ranjith Ramadurai & Dr. Saswata Bhattacharya

Ph.D. Degrees Awarded (2015-2022)



Ongoing Ph.D. Students



List of Ph.D. Degrees Awarded

S.No	Name	Thesis Title	Guide	Status (Present)
1.	Ivaturi Srikanth	Effect of Carbon nanotubes/nanofibers Reinforcement on Mechanical and Thermal Properties of CFRPs	Prof. Ch Subrahmanyam	Graduated
2.	Jagga Rao	Understanding and Control of Recrystallization Texture in Severely Deformed Al – 2.5wt.%Mg Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
3.	Palli Srinivas	Theoretical and Experimental Studies of Single Metals (Cu and Ni) and Binary Ni-Cu alloy Electrodeposition in a Modified Hull cell: A Combinatorial Approach	Dr. Suhash Ranjan Dey	Graduated
4.	R. Manivannan	Gelcasting of High Temperature Radome Materials by Using Inorganic Binders	Prof. Ch Subrahmanyam	Graduated
5.	T Karthik	Structure Property correlation through electric field driven effects in lead free Na _{0.5} Bi _{0.5} TiO ₃ -based ferro/piezoelectric ceramics	Dr. Saket Asthana	Graduated
6.	Akkisetty Bhaskar	Molybdenum Oxide and Tin Oxide/Sulfide Nanostructured Materials for Anodes in Lithium Ion Batteries	Dr. M Deepa	Graduated
7.	Md. Zaid Ahmed	Evolution Of Microstructure and Crystallographic Texture During Thermo-Mechanical Processing By Warmrolling In A Duplex Stainless Steel	Dr. Pinaki Prasad Bhattacharjee	Graduated
8.	Rajamallu K	Design and Development of β Ti alloys through First Principles Calculations and Powder Metallurgy route for Biomedical Applications	Dr. Suhash Ranjan Dey	Graduated
9.	Bandi Mallesham	Structure, Cation Ordering and Phonon studies of Pb(Fe _{0.5} -xScxNb _{0.5})O ₃ , a Multiferroic Relaxor : Bulk and Thin Films	Dr. Ranjith Ramadurai	Graduated
10.	Bolla Reddy Badapati	Uniaxial Compression and Spherical Indentation Behavior of Porous Copper	Dr. Pinaki Prasad Bhattacharjee	Graduated
11.	Mandati Sreekanth	Fabrication of CuInSe ₂ and Cu(In,Ga)Se ₂ Absorber Layers by Pulse-and Pulse-reverse Electrochemical Techniques for Solar Photovoltaic Applications	Dr. Suhash Ranjan Dey	Graduated

S.No	Name	Thesis Title	Guide	Status (Present)
12.	Venakateswarar ao. M	Structural, Electrical, Optical and Magnetic properties of $Y_{1-x}Bi_xCrO_3$ and $Nd_{1-x}Bi_xCrO_3$ ($x=0$ to 0.15) Ceramics	Dr. Ranjith Ramadurai	Graduated
13.	Basanth Kumar. K	Thermomechanical Processing, Microstructure and Texture Studies of TiHy 600 alloy (a Near Alpha Titanium Alloy)	Dr. Suhash Ranjan Dey	Graduated
14.	G. Dan Sathiaraj	Development of microstructure and crystallographic texture during thermo-mechanical processing of equiatomic CoCrFeMnNi high entropy alloy	Dr. Pinaki Prasad Bhattacharjee	Graduated
15.	Kumaraswamy Miriyala	Texture and Microstructural Influence on Piezoelectric Properties of $Na_{0.5}Bi_{0.5}TiO_3$ Thin Films: A Lead Free Piezoelectric Material	Dr. Ranjith Ramadurai	Graduated
16.	Sushmita Chaudhari	Dip Coating of $Cu_2ZnSn(SxSe_{1-x})_4$ Absorber Layer for Solar Photovoltaic Applications	Dr. Suhash Ranjan Dey	Graduated
17.	Damodar Devarakonda	Nanostructured carbons from commercial and bio-waste precursors for energy applications	Dr. Atul Suresh Deshpande	Graduated
18.	K. Prabakar	Growth and Characterization of lead free Multiferroic ($Ba_{0.85}Ca_{0.15}$) ($Zr_{0.10}Ti_{0.90}O_3$ - $CoFe_2O_4$ Nano Composite Thin Films	Dr. Ranjith Ramadurai	Graduated
19.	S S Satheesh Kumar	Hot Deformation Behaviour of a Powder Metallurgy Nickel Base Superalloy	Dr. Pinaki Prasad Bhattacharjee	Graduated
20.	Yembadi Rajkumar	Synthesis and sintering kinetics of MAX phase powders	Dr. Bharat Bhooshan Panigrahi	Graduated
21.	Vajinder Singh Arora	Microstructure, Phase Stability and High Temperature Deformation Behavior in γ -TiAl based (Ti-45Al-8Nb-xCr-0.2B) Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
22.	Kannan PK	Synthesis of vacuum based CZTSSe thin films for solar photovoltaic applications	Dr. Suhash Ranjan Dey	Graduated
23.	Kirtiratan Godbole	Quenching and partitioning treatments to resolve temper embrittlement problem and to improve mechanical properties of 12Cr martensitic steel	Dr. Bharat Bhooshan Panigrahi	Graduated
24.	M Anandkumar	Novel multi-component equiatomic single-phase fluorite oxide	Dr. Atul Suresh Deshpande	Graduated

S.No	Name	Thesis Title	Guide	Status (Present)
		nanoparticles - synthesis, properties, and applications		
25.	Saj Mohan M M	Influence of Strain and Anisotropy on Structure of BiFeO ₃ Epilayers and their Utilization as Interface Driven Heterostructures for Multiferroic Device Applications	Dr. Ranjith Ramadurai	Graduated
26.	Sandeep S	A Phase-Field Study of Elastic Stress Effects on Phase Separation in Ternary Alloy Systems	Dr. Saswata Bhattacharya	Graduated
27.	Irfan Samad Wani	Processing, Structure and Mechanical Behavior of Dual Phase and Nano-lamellar Eutectic High Entropy Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
28.	J Tushar Duryodhanrao	Computational Modeling and Simulations of Process-Microstructure-Property Relations in Model Ni-base Superalloys	Dr. Saswata Bhattacharya	Graduated
29.	Mane Rahul Bapurao	Sintering Mechanisms of Mechanically Alloyed High Entropy Alloy Powders	Dr. Bharat Bhooshan Panigrahi	Graduated
30.	Soumya Bandyopadhyay	A Phase-Field Study of Electromechanical Effects on Domain Evolution and Polarization Switching in Bulk, Thin-Film and Multi-layer Ferroelectric Perovskite Oxides	Dr. Saswata Bhattacharya	Graduated
31.	Usha Rani	Influence of precursors and processing conditions on porous carbon- and carbon-based materials for high performance supercapacitors	Dr. Atul Suresh Deshpande	Graduated
32.	Brijesh Singh Yadav	Investigation on inkjet printed CIGS thin film absorber layer for solar cell application	Dr. Suhash Ranjan Dey	Graduated
33.	Illa Mani Pujitha	Bacterial cellulose based carbon anode for lithium ion batteries	Dr. Mudrika Khandelwal	Graduated
34.	Mokali Veeresham	Processing, Microstructure and Properties of Refractory High Entropy Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
35.	Narayanaswamy Sake	Large Strain Thermo-Mechanical Processing of Ultrafine Pearlite:	Dr. Pinaki Prasad Bhattacharjee	Graduated

S.No	Name	Thesis Title	Guide	Status (Present)
		Microstructure and Crystallographic Texture		
36.	Sahil Rohila	Phase evolution, sintering and mechanical properties of AlCoCrFeNi high entropy alloy	Dr. Bharat Bhooshan Panigrahi	Graduated
37.	Seelam Rajshekar Reddy	Nanostructure Design Pathways using Novel Processing Strategies for Tailoring Mechanical Properties of Eutectic High Entropy Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
38.	Anantha Padmanabha Bhat S	Strain engineering in Multiferroic Nano Composites of Ba _{0.85} Ca _{0.15} Zr _{0.1} Ti _{0.9} O ₃ and CoFe ₂ O ₄ for magneto-electric devices	Dr. Ranjith Ramadurai	Graduated
39.	Dhiman Banik	Structural and ferroelectric transition studies on morphotropic compositions of x[Ba(Zr _{0.2} Ti _{0.8})O ₃] – (1-x)[(Ba _{0.7} Ca _{0.3})TiO ₃]	Dr. Ranjith Ramadurai	Graduated
40.	Jaydeep Saha	Thermo-mechanical Processing of Equiatomic CoCrNi Medium Entropy Alloy: Microstructure and Crystallographic Texture	Dr. Pinaki Prasad Bhattacharjee	Graduated
41.	Shiva Kalyani Adepu	Bacterial cellulose composites and in situ modifications for food packaging and drug delivery	Dr. Mudrika Khandelwal	Graduated
42.	Upendar Sunkari	Microstructural Engineering using Thermo-Mechanical Processing for Enhancing Mechanical Properties of Brittle Intermetallic Containing High Entropy Alloys	Dr. Pinaki Prasad Bhattacharjee	Graduated
43.	Urbashi Mahanta	Bio-Inspired materials with superhydrophobic and super hydrophilic surfaces as functional coatings	Dr. Atul Suresh Deshpande	Graduated
44.	Aamani S	Corrosion studies in grain boundaries engineered austenitic stainless steel.	Dr. Bharat Bhooshan Panigrahi	OC completed
45.	Rameez Tamboli	Role of Aluminium addition in interstitial free steel and interstitial free high strength steel	Dr. Suhash Ranjan Dey	Graduated
46.	Kukkadapu Madhuri	Solution-processed CuIn(1-x)Ga _x Se ₂ absorber layer for solar cell application	Dr. Suhash Ranjan Dey	OC completed

S.No	Name	Thesis Title	Guide	Status (Present)
47.	Najathulla B C	PEDOT:PSS/Bacterial cellulose based bilayer soft actuator:	Dr. Mudrika Khandelwal	Graduated
48.	Kunda Siri kiran Janardhana Reddy	Design and Development of FeCoNiCuZn high entropy alloy through aqueous electrodeposition	Dr. Suhash Ranjan Dey	OC completed
49.	Bandaru Pravallika	Plasmonic effects in Ag-Cu alloy Nanostructures	Dr. Shourya Dutta Gupta	OC completed
50.	Bikash Tripathy	Development of cost effective high entropy alloys with superior mechanical properties by thermo mechanical processing	Dr. Pinaki Prasad Bhattacharjee	OC completed
51.	Sriram K	Spin pumping and magnetization dynamics in ferromagnet-Heavy metal heterostructures	Dr. Chandrasekhar Murapaka	OC completed
52.	Bibekananda Paikaray	Investigation of exotic spin configurations and their dynamics in multilayer magnetic thin film stacks	Dr. Chandrasekhar Murapaka	OC completed

Collobarations with Indian Institutes, Universities, and R&D Labs



IIT KANPUR
Indian Institute of Technology Kanpur



IIT MADRAS
Indian Institute of Technology Madras



GITAM
(DEEMED TO BE UNIVERSITY)
NAAC A++ ACCREDITED



Indian Institute of Science
भारतीय विज्ञान संस्थान



SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
Deemed to be University u/s 3 of UGC Act, 1956



हैदराबाद विश्वविद्यालय
University of Hyderabad

Industry Collobarations



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CSIR - National Institute for Interdisciplinary Science and Technology (NIIST)
Council of Scientific & Industrial Research (CSIR), Ministry of Science and Technology, Govt of India
Industrial Estate PO, Thiruvananthapuram, Kerala-695019.



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CHALMERS





Students Corner

Testimonials

Dr. Anantha Padmanabha Bhat, MS16RESCH11001 (Research Engineer, Saint-Gobain Research India) : I am highly grateful for my experience in the MSME Department at IIT Hyderabad. The department provided a solid foundation and extensive knowledge of Material science. The faculty members are highly knowledgeable, approachable, and supportive. The department's state of art facility helped me to contribute to scientific advancements. The experience and knowledge gained from faculties and Dept have set a strong foundation for my career.

Dr. B Santhosh, MS16MTECH11002 (Guest Faculty, JNTUH College of Engineering Sultanpur) : I completed my B.Tech. at a college that had limited facilities for acquiring practical knowledge. Being a master's student at IITH provided me with theoretical and practical knowledge. There are excellent facilities here, and the professors are friendly and knowledgeable. The culture at IITH is wonderful, and I was able to familiarize myself with and understand people from various cultures and backgrounds. There is radiative cooling in the hostels at IITH, which is a fantastic feature. Finally, IITH is a great place to study and have a good time.