

# Ph.D. Admissions: July 2024

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Materials Science &  
Metallurgical Engineering  
<https://msme.iith.ac.in/>



# MSME Ph.D. Programme

*The Doctor of Philosophy (Ph.D.) program is for enthusiastic students with strong analytical skills and very good academic backgrounds willing to take up challenging research problems in various areas of Materials Science and Metallurgical Engineering. Research areas include design and development of novel materials for structural and functional applications, development of novel characterization procedures, computational materials science and materials informatics, development of novel processing techniques, metal additive manufacturing, metal joining, novel semiconductor fabrication, spintronics, plasmonics, multiferroics and so on.*

## Selection process



Shortlisted candidates will be called for the selection process.

Selection will be conducted based on written test and/or interview.



visit [www.iith.ac.in](http://www.iith.ac.in) for more information and apply online



## Contact details

MSME Ph.D. Admissions Committee

Department of Materials Science & Metallurgical Engineering

Email: [phd.admissions@msme.iith.ac.in](mailto:phd.admissions@msme.iith.ac.in)

Materials processing

Advanced Alloys and Composites

Functional materials and devices – multiferroics, semiconductors, metamaterials, spintronics, plasmonics

Advanced Materials Characterization

MSMIE

Electrochemical Materials Engineering

Computational Materials Science, Multiscale modeling, Materials Informatics

Health care & Bio-Materials

Research areas

Sustainable materials

Nanoscience & Nanotechnology

Energy materials

# Facilities at MSME

## Material Synthesis and Processing

- Pulse Laser Deposition
- E-beam deposition
- Planetary Ball mill
- Rolling mill
- Robotic GTA welding
- Uniaxial Compaction Press
- Cold-Isostatic Press
- Induction-melting furnace
- Arc-melting furnace
- Glass vacuum sealing
- Spin and Dip coater
- Sputtering
- Hot press
- High Temperature Vacuum Furnace
- Infra-red heating furnace
- Muffle and tube furnaces
- Salt-bath furnace
- Autoclave Ovens
- Incubator shaker
- Freeze drier
- Bio-safety cabinet
- Glove-box

## Computational

- Thermo-Calc
- DICTRA
- TC-Prisma
- COMSOL Multiphysics, ANSYS
- CrystalMaker Suite
- VASP
- State-of-the-art GPU clusters
- Inhouse NSM Supercomputing facility ParamSeva
- MicroSim



## Characterization

- Cold FEG-TEM
- FEG- SEM with EBSD
- Optical Microscopes
- FIB
- Ion-milling, PIPS
- SPM
- Surface area and porosity analyser
- Powder & thin film XRD
- UV visible spectrophotometer
- Raman spectrometer
- DTA, DSC, TGA, Dilatometer
- Universal testing machine (MTS, Instron)
- Creep Testing
- Hardness Tester
- Wear (Pin-on-disk)
- Nanoindenter
- Electrochemical analyser
- Viscometer

# MSME Faculty

**Prof. B. S. Murty**

- Nanocrystalline materials
- Thermodynamics & kinetics of phase transformations
- High entropy alloys
- Bulk metallic glasses
- TEM and atom probe tomography

[bsm@msme.iith.ac.in](mailto:bsm@msme.iith.ac.in) +91 (40) 2301 6001



**Prof. Pinaki P. Bhattacharjee**

- Design and Development of High Entropy Alloys
- Development of metallic alloys for advanced and emerging applications
- Materials processing, microstructure, and crystallographic texture
- Bulk ultrafine/nanostructured and heterogeneous materials
- Application of high-resolution Electron Back Scatter Diffraction (EBSD) and Transmission Electron Microscopy (TEM) in materials characterisation.

• Mechanical properties of materials  
[pinakib@msme.iith.ac.in](mailto:pinakib@msme.iith.ac.in) +91 (40) 2301 6551



**Prof. G.D. Janaki Ram**

- Welding
- Additive manufacturing

[jram@msme.iith.ac.in](mailto:jram@msme.iith.ac.in) +91 (40) 2301 6565



**Prof. Bharat B. Panigrahi**

- Powder Metallurgy & Sintering Mechanisms
- High Entropy Alloys, MAX Phases and MXene,
- Advanced ceramics & composites
- Microstructure-Mechanical Properties of Steels
- Metal Additive Manufacturing,
- Electro-Spark Coating, Wear & Tribology

[bharat@msme.iith.ac.in](mailto:bharat@msme.iith.ac.in) +91 (40) 2301 6555



**Prof. Suhash R. Dey**

- Electrochemical Materials Engineering (Additive Manufacturing, Metal/metal oxide assisted electrochemical reduction of CO<sub>2</sub>, Recovery and recycling of spent Lithium-ion batteries, Silicon PVs electrochemically, Molten salt electrolysis for new age applications, Recovery from electronic wastes using microbial fuel/electrolytic cell)
- Advanced Multi-Functional Nanostructured Materials/High Entropy Alloys: Combinatorial Alloy Design

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# MSME Faculty

## Prof. Saswata Bhattacharya

- Phase transformations in alloys and oxides
- Phase-field modelling of microstructural evolution
- Discrete Dislocation Dynamics
- Materials Informatics – Inverse Modeling
- Development of Multiscale Modeling Techniques and Tools for ICME

[saswata@msme.iith.ac.in](mailto:saswata@msme.iith.ac.in)



## Dr. Atul S. Deshpande

- Nanoparticle synthesis and self-assembly, sol-gel processes, templating techniques
- Novel nanostructured materials for advanced applications, including catalysis, energy storage and superhydrophobic coatings
- High entropy oxides

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## Prof. Ranjith Ramadurai

- 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 heterostructures 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 utilising scanning probe microscope

[ranjith@msme.iith.ac.in](mailto:ranjith@msme.iith.ac.in) +91 (40) 2301 6553

## Dr. Mudrika Khandelwal

- High-performance and functional green composites
- Liquid crystals and self-assembly
- Drug Delivery
- Anti-fouling and anti-microbial materials
- Depth filters
- Energy storage and conversion (actuators)
- Nanofibrous devices, functional textiles

[mudrika@msme.iith.ac.in](mailto:mudrika@msme.iith.ac.in)



## Dr. Subhradeep Chatterjee

- Phase Transformations and Microstructure Development
- Laser and Electron Beam Processing
- Welding and Surface Treatment
- Modelling and Simulation (Phase Field/FEM/CVM)

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# MSME Faculty

## Dr. Rajesh Korla

- Deformation at room temperature
- Creep and super-plasticity
- Micro mechanical deformation
- Molecular dynamic simulations
- Nano indentation

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## Dr. Mayur Vaidya

- Diffusion-Deformation correlations in materials
- Phase growth and interdiffusion kinetics in thermoelectric materials
- Diffusion in multicomponent alloys
- Processing, characterisation and stability of nanocrystalline alloys

[vaidyam@msme.iith.ac.in](mailto:vaidyam@msme.iith.ac.in) +91 (40) 2301 6564



## Dr. Sairam K. Malladi

- In situ characterisation and technique development using MEMS devices (lab on a chip)
- Applications of *in situ* and correlative characterisation techniques to understand transformations in materials, Electrochemistry and Corrosion

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## Dr. Shourya Dutta Gupta

- Plasmonics and Nanophotonics
- Sensors, Lab-on-a-chip devices, Microfluidics
- Alternative materials for plasmonics
- 2D Materials based optoelectronics

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## Dr. Chandrasekhar Murapaka

- Spintronic-based memory and logic devices
- Nanomagnetic materials, Domain wall dynamics in ferromagnetic networks
- Spin torque nano-oscillators for RF applications
- Spin-orbit torque-induced magnetisation switching and dynamics, Magnetic tunnel junctions
- Micro and Nanofabrication techniques

[mchandrasekhar@msme.iith.ac.in](mailto:mchandrasekhar@msme.iith.ac.in) +91 (40) 2301 6562



# MSME Faculty

## Dr. Ashok Kamaraj

- Process metallurgy
- Physical modeling of unit processes
- Iron and steelmaking
- Life cycle analysis of processes and products
- Development of alloy steels

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## Dr. Anuj Goyal

- Computational Material Science
- Multiscale modeling
- Electronic structure theory
- Defects thermodynamics, Point defects
- Dislocations and interfaces
- Metals and semiconductors (oxides, nitrides, chalcogenides, halides).

[anujgoyal@msme.iith.ac.in](mailto:anujgoyal@msme.iith.ac.in) +91 (40) 2301 6567



## Dr. Deepu J. Babu

- Nanoporous materials
- CVD, Adsorption and Membrane-based gas separation applications
- Carbon nanomaterials, MOFs
- Graphene & Graphyne and other 2D materials
- Defect Engineering, Plasma functionalisation

[deepu.babu@msme.iith.ac.in](mailto:deepu.babu@msme.iith.ac.in) +91 8289995143



## Dr. Suresh Kumar Garlapati

- Printed electronics (transistors and CMOS logics)
- Oxide Semiconductors
- Electrolytes
- Organic electronics (transistors and chemiresistors)
- Gas sensors
- Memristors

[gsuresh@msme.iith.ac.in](mailto:gsuresh@msme.iith.ac.in) +91 9100930553



## Dr. Suresh Perumal

- Thermoelectric Materials, Metrology and Devices
- Magnetic Refrigeration
- Energy Storage devices
- Powder Metallurgy

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# Proposed Ph.D. topics (not an exhaustive list)

- Spintronic materials for neuromorphic devices
- CVD synthesis of porous 2D materials
- Novel materials for energy production, conversion and storage
- Nanophotonics-based sensors and modulators
- Multiscale modeling of process-structure-property relations in multiferroic materials (Involves integration of first principles calculations, atomistic simulations and mesoscale phase-field models)
- Through-process modeling of single crystalline superalloy turbine blades
- Through-process modeling of additively manufactured titanium alloys using Directed Energy Deposition technique
- Printed electronics (oxide semiconductors, organic electronics, TFTs), sensors and memristors
- Green synthesis of multimetallic alloys/oxides, Molten salt electrolysis of new age materials

# Proposed Ph.D. topics (not an exhaustive list)

- Powder metallurgy, high entropy alloys, processing and properties of steels, powders for additive manufacturing, ultrahigh temperature composites
- Developing ab initio approaches to model charged defects in semiconductors for functional applications
- Developing atomistic approaches to model stacking faults and dislocations in metal alloys
- Applications of Machine Learning for Accelerated Materials Design
- Welding metallurgy
- Engineering nanofibrous materials
- Phase transformations and microstructure evolution in thin films
- Other areas of metallurgy and materials science

# Sponsored Project Ph.D. topics

- Printed, wearable sensor array for non-invasive monitoring of diabetic complications and chronic kidney diseases” (PI: Dr. Suresh Kumar Garlapati, Funding Agency: MoE-STARS)
- Through-process modeling of single crystalline superalloy turbine blades (PI: Prof. Saswata Bhattacharya, Funding Agency: ARDB-GTMAP)
- Through-process modeling of additively manufactured titanium alloys using Directed Energy Deposition technique (PI: Prof. Saswata Bhattacharya, Funding Agency: DIA-COE DRDO)
- Super-spintronics for THz generation: spin to charge conversion in ferromagnet/superconducting layers. (PI: Dr. Chandrasekhar Murapaka, Funding Agency: MoE-STARS)
- Development of Heusler alloy films with large Anomalous Hall effect. (PI: Dr. Chandrasekhar Murapaka, Funding Agency: ERIPR-DRDO)
- Exploring ancient Indian panchadhatu/asthadhatu-making (high entropy alloys) with new compositions and combinations for modern age applications (PI: Prof. Suhash Ranjan Dey, Funding Agency: DST-SHRI)

Note that several projects are running in the Department. If candidates are found suitable, they will be later notified about various open positions through funded projects.

# 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 the required qualifications (mentioned below) are encouraged to apply. Externally funded candidates (non-MoE) are encouraged to contact interested MSME faculty before the exam/ interview schedule.

**Candidate should have one of the following qualifications:**

- M.Tech./M.E. or equivalent degree (with a minimum first-class) in Materials Science and Engineering, Metallurgical Engineering, Ceramics, Mechanical Engineering, Manufacturing/ Production Engineering, Nanoscience, Polymer, Biomaterial, Chemical Engineering and other relevant areas. **OR**
- Direct Ph.D. - B. Tech. / B.E. in the above disciplines with a CGPA of 8.0 (Gen) and 7.5 (for all others) and a valid GATE score. The GATE criterion is not mandatory for B.Tech. or B.S. students graduating from an IIT/ IISc-B/ NIT /IISER or any CFTI. **OR**
- MSc or equivalent in Materials Science/ Physics/ Chemistry / Biology or equivalent degree with a valid GATE Score in a relevant area or joint CSIR-UGC JRF, DST-Inspire, qualified or equivalent exam. **OR**
- Candidates working in industry and R&D Labs with a first-class B.Tech/B.E. or equivalent Degree in a relevant discipline and two years of experience are eligible to apply as an external Ph.D. student. GATE is not mandatory for them. However, they must provide an NOC from their current employer as well as a DSIR certificate.

**Please note: - mere fulfillment of the eligibility criteria does not guarantee shortlisting  
- only candidates shortlisted for written test and/or interview would be intimated (by email)**