

Ph.D. Admissions: December 2023

Materials Science &
Metallurgical Engineering

<https://msme.iith.ac.in/>



MSME Ph.D. Programme

The Doctor of Philosophy (Ph.D.) program is for enthusiastic students 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.*

Selection process



Shortlisted candidates will be called for the selection process.
Selection will be conducted based on written test and/or interview.

UGC-CSIR-JRF qualified candidates are directly allowed to appear for the interview.



visit www.iith.ac.in for more information and apply online

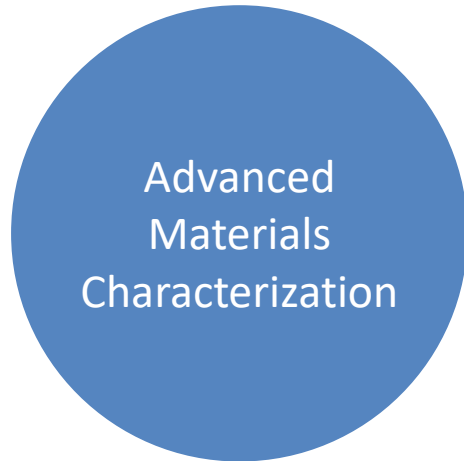
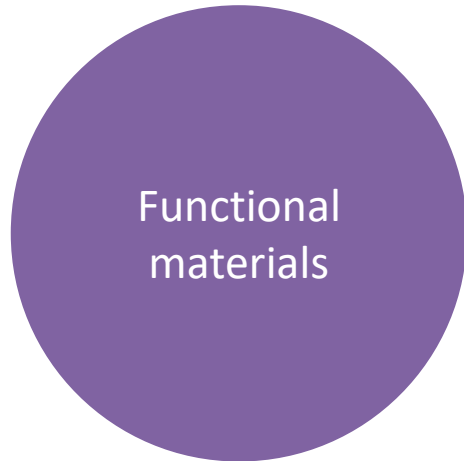
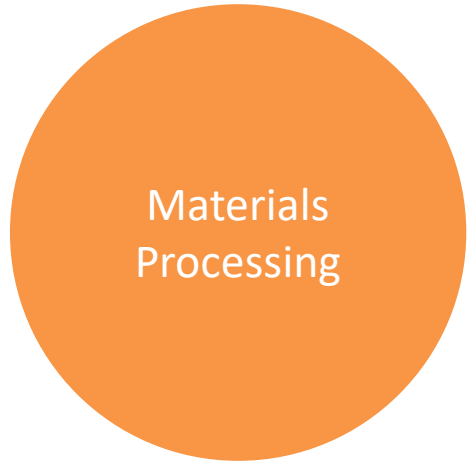


Contact details

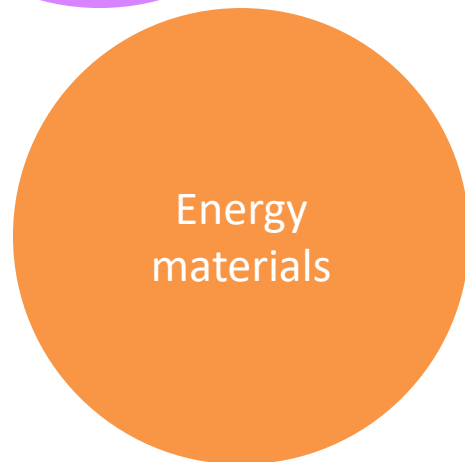
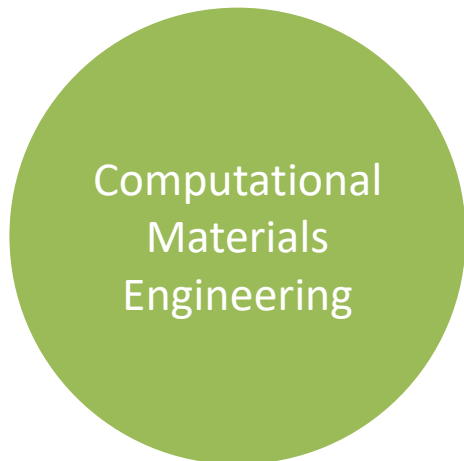
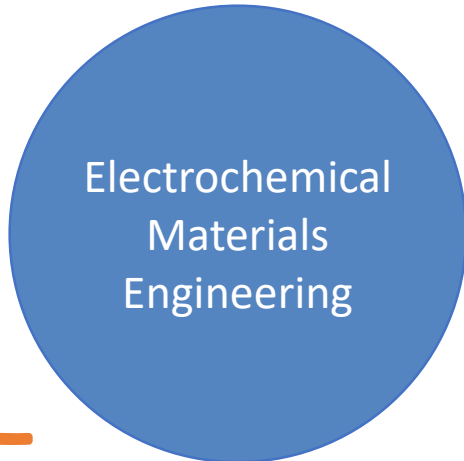
MSME Ph.D. Admissions Committee

Department of Materials Science & Metallurgical Engineering

Email: phd.admissions@msme.iith.ac.in



MSME



Research areas

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
- Medea
- CrystalMaker Suite

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 analyzer
- 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 +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 +91 (40) 2301 6551



Prof. G.D. Janakiram

- Welding
- Additive manufacturing

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

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Prof. Suhash R. Dey

- Electrochemical Materials Engineering (Additive Manufacturing, Metal/metal oxide assisted electrochemical reduction of CO₂, 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

suhash@msme.iith.ac.in +91 (40) 2301 6552



MSME Faculty

Prof. Saswata Bhattacharya

- Phase transformations in alloys and oxides
- Phase-field modelling of microstructural evolution
- Discrete Dislocation Dynamics Simulation of Mechanical Behavior
- Physics-informed Machine Learning for Inverse Problems in Materials Design
- Development of Multiscale Models

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

atuldeshpande@msme.iith.ac.in +91 (40) 2301 6554



- 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 +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



Dr. Subhradeep Chatterjee

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

subhradeep@msme.iith.ac.in +91 (40) 2301 6558



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

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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

srkm@msme.iith.ac.in +91 (40) 2301 6560



Dr. Shourya Dutta Gupta

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

shourya@msme.iith.ac.in +91 (40) 2301 6561



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

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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 +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 +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 +91 9100930553



Dr. Suresh Perumal

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

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MSME

Proposed topics

(Not an exhaustive list)

- Spintronic materials for neuromorphic devices
- Carbon capture technologies
- Novel materials for energy production, conversion and storage
- Nanophotonics-based sensors and modulators
- Multiscale modelling of process-structure-property relations in multiferroic materials (Involves integration of first principles calculations, atomistic simulations and mesoscale phase-field models)
- Powder metallurgy, high entropy alloys, processing and properties of steels, powders for additive manufacturing, ultrahigh temperature composites
- Engineering nanofibrous materials
- Other areas of metallurgy and materials science

- Two additional open positions through **funded projects**
 - “Fundamental understanding of electrochemical deposition of a new quinary alloy system of transition elements deposited from aqueous electrolytes” (PI: Prof. Suhash Ranjan Dey, Funding Agency: CSIR)
 - “Printed, wearable sensor array for non-invasive monitoring of diabetic complications and chronic kidney diseases” (PI: Dr. Suresh Kumar Garlapati, Funding Agency: MoE-STARS)

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 highly encouraged to apply.** Externally funded candidates (non-MoE) are encouraged to contact their preferred MSME faculty before the exam/ interview schedule.

Candidate should have one of the following qualifications:

- M.Tech./M.E. or equivalent degree 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 8.5 (Gen) and 8.0 (for all others) and a valid GATE score. For project Ph.D. candidates, B. Tech. / B.E. in the above disciplines with a CGPA of 8.0 (Gen) and 7.5 (for all others), along with 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 holding regular positions in Government organizations and R&D Labs with a B.Tech/B.E. or equivalent Degree with a CGPA of 8.0 and above 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.