

Ph.D. Admissions: July 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, 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 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

Materials Processing

Advanced Alloys and Composites

Functional materials

Advanced Materials Characterization

MSME

Electrochemical Materials Engineering

Computational Materials Engineering

Health care & Bio-Materials



Research areas

Sustainable metallurgy

Nanoscience & Nanotechnology

Energy materials

Facilities at MSME

Material Synthesis and Processing

- Pulse Laser Deposition
- E-beam deposition
- Planetary Ball mill
- Rolling mill
- Robotic 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

- Thermocalc
- DICTRA
- TC-Prisma
- Quantum Espresso
- LAMMPS

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)
- Nanoindentor
- 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 characterization.
- Mechanical properties of materials

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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

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MSME Faculty

Dr. Saswata Bhattacharya

- Phase transformations in alloys and oxides
- Phase-field modelling of microstructural evolution
- Modelling deformation of materials using discrete dislocation dynamics and continuum crystal plasticity
- Microstructure-property correlations

saswata@msme.iith.ac.in +91 (40) 2301 6556



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



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 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

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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)

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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

rajeshk@msme.iith.ac.in +91 (40) 2301 6559



Dr. Mayur Vaidya

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

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Dr. Sairam K. Malladi

- In situ characterization and technique development using MEMS devices (lab on chip)
- Phase transformations in materials, Electrochemistry and Corrosion
- In situ TEM and Graphene based super capacitors, Materials for Energy Applications

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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 opto-electronics

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 magnetization 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 functionalization

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. Piyush Jagtap

- Thin film growth
- In-situ stress measurements
- Thin film mechanics
- Mechanical behavior of nanostructures
- Micro-electronic packaging
- Pb-free solders.

piyush.jagtap@msme.iith.ac.in +919632155932



MSME

Proposed topics

(Not an exhaustive list)

- Electrochemical Additive Manufacturing
- Metal/metal oxide assisted electrochemical reduction of CO₂: towards CO₂ recycling
- Recovery and recycling of spent Lithium ion batteries electrochemically
- Molten salt electrolysis for new age applications
- Recovery from electronic wastes using microbial fuel/electrolytic cell: a synergistic approach
- Fundamental understanding of electrochemical deposition of new quinary alloy system of transition elements deposited from aqueous electrolytes **(Project funded)**
- Computational approaches to defects modeling in materials.
- Nanoporous materials for carbon capture/H₂ storage
- Addressing the challenges in making advanced alloy systems (AHSS, LWS/LDS, HEA, etc.) for EVs and hydrogen transport
- Control of non-metallic-inclusion in maraging steels through the ICME approach
- Molten refining of metallurgical grade silicon to electronic grade silicon
- Development of sustainable steelmaking technologies
- Ferrimagnetic synaptic devices for neuromorphic computing applications
- Skyrmion based logic devices for spin based computing architecture
- Infusing heterogeneities for synergistic improvement of strength and ductility in high entropy alloys

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 (mentioned below) are highly encouraged to apply.** Externally funded candidates (non MoE) are encouraged to contact their preferable MSME faculty before 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 CGPA of 8.5 (Gen) and 8.0 (for all others), along with a valid GATE score. For project Ph.D. candidates, B. Tech. / B.E. in the above disciplines with 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 or equivalent degree with a valid GATE Score in relevant area or joint CSIR-UGC JRF, DST-Inspire, qualified or equivalent exam. **OR**
- Candidates holding the regular position, in the Government organization and R&D Labs, who has B.Tech/B.E. or equivalent Degree with CGPA 8.0 and above, in relevant discipline and having two years of experience are eligible to apply as external Ph.D. student. GATE is not mandatory for them.