

Ph.D. Admission Brochure

January 2017

Atoms to Applications



INDIAN INSTITUTE  
OF TECHNOLOGY  
HYDERABAD



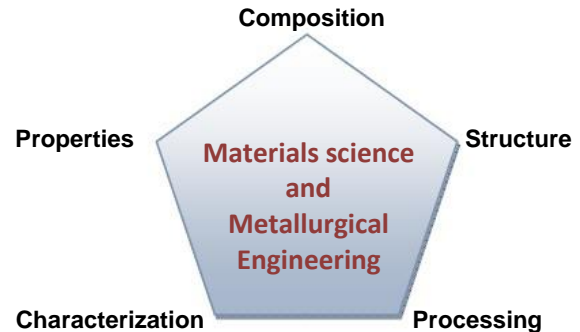
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# About the Department

The department of Materials Science & Metallurgical Engineering is one of eleven departments at IIT Hyderabad. The vision of the department is to be a globally recognized center of excellence in materials research translating fundamental understanding of materials into development of innovative, sustainable & environmental friendly technologies & products for social benefits and needs. The research philosophy of the department is imbibed in “Atoms to Applications” thus encompassing all aspects of materials science and metallurgical engineering from developing fundamental concepts to translating this concepts into material design & manufacturing for actual engineering applications. The department imbibes the students with the understanding of the interplay between fundamental aspects of materials science & metallurgical engineering, namely, composition, structure, processing, characterization and properties (“the MSME Pentagon”) and enables them to develop & innovate technologies. Developing unique courses (for e.g. Futuristic Materials) not usually taught in other IITs & user oriented programs-M.Tech. programs designed for specific target groups (Industries/PSUs) are part of teaching innovations of department. Course work offered in the department covers broad fields of materials science and metallurgical engineering from fundamentals to advanced and emerging areas such as thermomechanical processing, thin films and devices, nanomaterials, biomaterials, energy materials, electron microscopy to name a few, which impart strong foundation on several major aspects of materials science and engineering and enhance the state of the knowledge of the students to make them “future-ready” professionals.



## MSME Pentagon

Departmental collaborations exist with:

Universities

Ritsumeikan University, Japan

University of Lorraine, Metz, France

Kyoto University, Japan

Research laboratories

ARCI Hyderabad

DMRL Hyderabad

Laboratoire de CRISMAT, Caen, France

Industries:

General Electrics

Tata Steel

# Research Areas Offered



**Dr. Pinaki Prasad Bhattacharjee**, Associate Professor & Head of the Department

Areas of interest: Bulk ultrafine and nanostructured materials produced by severe plastic deformation processes and structure-property relationship in such materials, Crystallographic texture, Electron microscopy, Recrystallization behavior of metallic materials, Mechanical behaviour of materials, Development of Light metals (e.g. Al, Mg, Ti) alloys for novel applications, High entropy alloys

Contact: pinakib@iith.ac.in, +91 (40) 2301 6069



**Dr. Suhash Ranjan Dey**, Associate Professor

Areas of interest: Emerging alloys (solar cells, biomaterials, thermoelectrics) design through Combinatorial Approach, Materials processing and testing, Improvement of properties of various Titanium alloys through thermomechanical processing and phase transformation-microstructure characterization studies

Contact: suhash@iith.ac.in, +91 (40) 2301 6096



**Dr. Ranjith Ramadurai**, Assistant Professor

Areas of interest: Multiferroic oxide thin films for fundamental science and functional 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.

Contact: ranjith@iith.ac.in, +91 (40) 2301 7046, +91-9494424990



**Dr. Bharat Bhooshan Panigrahi**, Associate Professor

Areas of interest: Powder metallurgy & sintering mechanisms, Nanostructures and nano-particles, High temperature materials, Metallic materials & intermetallics, Advanced ceramics & composites, MAX-Phases ternary compounds, Mechanical properties, plastic deformation, Biomaterials and porous implants, Surface modifications and strengthening, Modelling & simulation of materials processes.

Contact: bharat@iith.ac.in, +91(40) 2301 7072 , Fax:+91(40) 2301 6032



**Dr. Atul Suresh Deshpande**, Assistant Professor

Areas of interest: Nanoparticle synthesis and self-assembly, sol-gel processes, templating techniques, novel nanostructured materials for advanced applications including catalysis, solid oxide fuel cells (SOFC), ferroelectric materials, bone replacement materials and drug delivery systems.

Contact: atuldeshpande@iith.ac.in, +91 (40) 2301 7044



**Dr. Saswata Bhattacharya**, Assistant Professor

Areas of interest: Phase transformations in alloys and oxides, phase-field modeling of microstructural evolution, microstructure-property correlations, modeling deformation behavior using discrete dislocation dynamics, continuum crystal plasticity, multi-scale modeling of functional materials.

Contact: saswata@iith.ac.in, +91 (40)2301 7107



**Dr. Mudrika Khandelwal**, Assistant Professor

Areas of interest: Bacterial cellulose and other natural materials- understanding structure, mechanism and applications, high performance green composites, liquid crystals and self-assembly of rod-like entities, fibre spinning, strategies for developing anti-fouling and anti-microbial materials, materials for tissue scaffolding.

Contact: mudrika@iith.ac.in, +91 (40)2301 7118



**Dr. Subhradeep Chatterjee**, Assistant Professor

Areas of interest: Phase Transformations and Microstructure Development, Laser and Electron Beam Processing, Welding and Surface Treatment, Modelling and Simulation (Phase Field/FEM/CVM).

Contact: subhradeep@iith.ac.in, +91 (40)2301 7075



**Dr. Rajesh Korla**, Assistant Professor

Areas of interest: Deformation at room temperature, creep and superplasticity, micro mechanical deformation, molecular dynamic simulations, nano indentation.

Contact: rajeshk@iith.ac.in



# Centers & Labs



The department has state-of-art laboratories well equipped with high end equipments. Some of the laboratories available for graduate & research scholars are:

Advanced Structural Lab

X-Material Innovation hub

Functional Materials Lab

High Temperature Materials Lab



# Facilities

The laboratories possess sophisticated equipment, some of them are:

## Characterization

- Scanning Electron Microscope (Carl Zeiss)
- Hot Stage Automated upright Microscope (Leica DM 6000M and Linkam Hot stage)
- Powder X-ray Diffractometer (PANalytical Xpert Pro)
- Atomic Force Microscope (Nanoscope -V, Veeco)
- Laser Micro-Raman spectrometer (SENTERRA Bruker)
- FTIR (TENSOR 37 Bruker)
- UV-VIS-NIR spectrometer (Shimadzu UV-3600)
- TGA/DTA (SDT Q200 TA Instruments)
- DSC (Q200 TA Instruments)
- FEG-SEM with EBSD & EDS (Carl Zeiss)

## Synthesis equipments

- Powder mixer
- Pre compaction press
- Cold Isostatic press
- Salt Bath Furnace
- Furnaces (Muffle Furnace (INDFURR), Tubular Furnace (INDFURR))
- High Energy Ball mill (Fritsch Pulverisette 7)
- Glove Box (mBraun, LAB star)

## Properties measurement

- Microhardness (EMCO TEST DURA SCAN)
- UTM (Fatigue) (MTS LANDMARK)
- Electrochemical Quartz Crystal Microbalance (HCH Instrument)
- Thermopower & Resistivity measurement system (ZEM -3 ULVAC-RIKO)
- Battery testing unit (ARBIN Instruments)
- Physical Properties Measurement System PPMS (Quantum Design- Dynacool)
- Precision Impedance analyzer (Agilent 4294A)

## Processing equipments

- Cutting Machine (Struers Discotom -16, Struers Secotom-15, Struers minitom)
- Automatic hot mounting press (Struers CitoPress -10)
- Polishing Machines (Struers LaboPol-5, ATM Saphir 330)
- Automatic polishing machine (Struers Tegramin-25)
- Low Speed Diamond Wheel Saw
- Low temperature bath (CINTEX)
- Electro polishing & etching machine (Struers LectorPol-5)
- Laboratory scale rolling equipment



# Programmes

The department offers undergraduate (B.Tech.) and postgraduate programmes (M.Tech. & Ph.D.).

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.

## ELIGIBILITY CRITERIA FOR ADMISSION TO PHD PROGRAM:

**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.**

### Qualifications:

1. **M.Tech/ME or equivalent degree in Materials Science and Engineering, Metallurgical Engineering, Ceramics, Mechanical Engineering, Nanoscience,**
2. **B Tech / BE (Non- IIT) in the above disciplines with CGPA of 8.5 and above, along with a valid GATE score OR B Tech students graduating from an IIT with a CGPA of 8.0 or above are eligible to apply. The GATE criterion is not mandatory for B.Tech students graduating from an IIT**
3. **MSc in Materials Science/Chemistry/Physics or equivalent degree With Valid GATE Score in CY/PH or joint CSIR-UGC JRF qualified.**
4. **Any other Master's Degree holders with Valid GATE score in MT/ME GATE papers**

# Selection Process

## Academics

Some of the courses offered by the department:

- Advanced Physical Metallurgy
- Thermochemical Processing of Materials
- Electron Microscopy
- Properties of Materials
- Thin Film Technology
- Material Synthesis & Characterization
- Advanced Materials Synthesis
- Materials for Green Energy
- Composite Materials
- Metallic Materials
- Powder Metallurgy Manufacturing
- Hierarchical Nanostructured Materials
- Thermodynamics and Kinetics of Materials
- Biomaterials- Materials in Medicine
- Soft Materials
- Introduction to Computational Methods



# Contacts

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# Reaching IIT Hyderabad

