

# Chirantandip Mahanta | CV

emails: chirantandipmahanta@gmail.com | mm19b029@smail.iitm.ac.in

## EDUCATION

Inter-Disciplinary Dual Degree (IDDD)	Computational Engineering	Indian Institute of Technology, Madras.
Bachelor of Technology (B.Tech)	Metallurgical and Materials Engineering	Indian Institute of Technology, Madras
Minor	Physics	Indian Institute of Technology, Madras

## CORE COMPETENCIES

Theory	Phase-Field Theory, Phase Transformations in Metals & Alloys, Thermodynamics & Statistical Physics, Physical Metallurgy, Mechanical Behavior
Simulation	Numerical Methods for PDEs, Finite Element Analysis, Approximation Methods, Numerical Linear Algebra.
Microscopy	X-Ray Diffraction, Scanning Electron Microscopy, Transmission Electron Microscopy (Theory), Atom Probe Tomography (Theory, Post Processing)
Computing	High Performance Computing (C/C++ - SYCL, OpenCL, MPI, OpenMP, CUDA, Intel-OneAPI), Thermo-Calc, pyCalphad, deal.ii, Data Analysis & Visualisation (python - SciPy, TensorFlow, NumPy etc.)

## RESEARCH EXPERIENCE

### Integrated Computational Materials Engineering Lab | Guide: Prof. G. Phanikumar

A Multi-Phase-Field software development for large scale simulations coupled with thermodynamic database.

*IDDD Project Aug 2023 | Ongoing*

- Numerically solved a multi-phase-field version of the Kim-Kim-Suzuki model with thermodynamic database coupling.
- Studied the solidification of AlZn, NiAl, NiNb and NiAlMo systems; eutectic of Al-Zn and the L12 precipitate of NiAlMo.
- Code developed in C++ using SYCL, MPI and OneAPI. Simulations were bookmarked against existing MicroSim solvers.
- Learned : Intermediate Phase-Field (WB, KKS models etc.), Computational Thermodynamics.

Phase-Field modelling of basic microstructure evolution phenomenon.

*UG Research Course I & II (15 credits) | July 2021 - May 2022*

- Simulated Diffusion, Spinodal Decomposition and Dendritic Solidification numerically with the Finite Difference method.
- Investigated the effect of undercooling, boundary conditions, anisotropy and other parameters on the microstructure.
- Developed three parallel programs in C/C++ with each of OpenCL, MPI and SYCL frameworks in their respective style.
- Tested the programs across devices (CPUs, GPUs) and platforms (Intel, Nvidia) for efficiency, scaling, memory usage etc.
- Learned : Basic Phase-Field, Solidification, OpenCL, SYCL, MPI.

## Combinatorial Alloy Design & Correlative Microscopy Group | Guide: Prof. K. G. Pradeep

Synthesis and characterization of the FeMnCoCrCu High Entropy Alloy.

*B. Tech Project (9 credits) | July 2022 - Nov 2022.*

- Casted multiple Cu varying alloy compositions in the Vacuum Induction Furnace & performed solutionizing treatments.
- Used X-Ray Diffraction and Optical Microscopy to calculate grain size and morphology and identify precipitates formed.
- Learned : XRD calculations, Optical Microscopy, Sample Polishing.

## Atom Probe Tomography (APT) Data Analysis for feature detection in a MAX Phase

*Young Research Fellowship Project | Oct 2021 - June 2022.*

- Identified the elements and their distribution from the mass spectrum and raw APT data of a  $Cr_2Al(Si)C$  MAX Phase.
- Learned and implemented Cluster Analysis, Proximity histograms and Distribution Maps to extract interfaces and clusters.
- Learned : Mass-Spectrum Analysis, MAX-Phases, APT Theory & Data Post Processing.

## Minor Projects & Term Papers

Paper Review Presentation | Advanced TEM Course.

- Reviewed the method for the determination of the wave aberration function for HRTEM proposed by [Meyer et al].

A critical review of the steady state creep behavior of an alloy.

- Calculated creep activation energy and stress exponent by fitting the creep equation to the creep curve [Pandey et al].
- Identified the LSR mechanism to be gb diffusion controlled gb sliding and the HSR mechanism to be dislocation creep.

Calculation of phase diagrams within the regular solution model.

- Calculated eutectic and peritectic phase diagrams of binary solid-solutions by the common-tangent construction method.

## WORKSHOPS

MicroSim Workshops 4.0 & 3.0 IIT Madras, Jan 2024 ; IISC Bangalore July 2023

- Assisted in training attendees in the OpenCL based MicroSim Solver.
- Trained on using the CUDA, AMReX, MPI and OpenFOAM based MicroSim solvers for microstructure simulations.

NFAPT Summer School On Materials Characterization IIT Madras, July 2023

- Trained on Thermo Fischer's Axia ChemiSEM instrument and imaged (SEM & EDS) a few standard samples.
- Attended live demonstrations of APT operation and Data Analysis (IVAS) by CAMECA professionals at NFAPT, IITM.
- Learned about the instruments, applied theory and practical challenges of SEM, EDS, EBSD, TEM, FIB and APT.

## EXTRA-CURRICULAR ACTIVITIES

Organizer @ NFAPT (National Facility of Atom Probe Tomography) Anniversary 2022 @ IITM

- Helped organise NFAPT Annual Lecture Series 2022 and also designed the 4th NFAPT Newsletter.

Industry Cohort Member @ GRAIN IITM

- Identified challenges in the GTRE Kaveri program via collaborative efforts with professors and industry experts.
- Proposed an Integrated-Computational framework to accelerate design, simulations and experimental validation.
- Advocated for a National Materials Database; developed methods for data collection, pre-processing and analysis.

Mentor Avanti Fellows IITM

- Mentored 2 students throughout their college preparation; Tutored them academically; Both got into IIT Madras.

## RELEVANT COURSEWORK

---

Computational Engineering :	Finite Element Analysis, Applications of Molecular Dynamics, Atomistic Modelling of Materials, Computational Materials Thermodynamics, High Performance Computing
Microscopy :	The Field Emission Sciences and Atom Probe Tomography, Materials Characterisation, Advanced Transmission Electron Microscopy.
Metallurgy :	Physical Metallurgy, Thermodynamics of Materials, Phase Transformations, Deformation & Failure of Materials, Transport Phenomenon
Physics :	Quantum Mechanics I & II, Statistical Physics, Classical Mechanics, Superconductivity, Physics of Materials, Physics & Tech of Thin Films.

---

## SCHOLASTIC ACHIEVEMENTS

- Young Research Fellowship (YRF) ([link](#))  
Among the top 30 to receive the prestigious Young Research Fellowship (with 200+ applicants) at IIT Madras.
- Samsung Star Scholarship by Samsung India
- Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship ([link](#))  
Attained All India Rank 671 in the KVPY Aptitude test and got selected for the scholarship.
- Recieved the Dakshana Scholarship for All India Jawahar Navodaya Vidyalaya students