



# RAM MUNDE

Senior Undergraduate (B.Tech)  
Materials Science and Engineering


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Ram Munde  | Ram Munde 

## ACADEMIC QUALIFICATIONS

Degree	Institute	Year of Completion	CPI/%
B.Tech, MSE	Indian Institute of Technology Delhi	2024	8.2/10
AISSE (MSBSHSE)	Ganesh Public School, Kaij	2020	80.0%
AISE (MSBSHSE)	Saraswati Public School, Latur	2018	96%





## INTERNSHIPS

- **United Phosphorus Limited - Research Associate** *Agromolecule Analysis* May-Jul '23
  - Enhanced the organization's decision-making power by creating a sophisticated portal for chemical molecule analysis. Developed a strong machine learning model to forecast the viability of chemical molecules for agro-chemical products using density functional theory for energy of formation calculation. Integrated Python API from open-source libraries for  $\Delta G_H$  analysis.


*Received letter of recommendation from Global Manager, United Phosphorus Ltd *
- **Cooper Union Edu. New York - Invention Intern** *Product Prototyped at IITGN* May-July '22
  - Developed a strong foundation in materials characterization techniques, including SEM, XPS, TEM, XRD, FTIR, AFM, and DSC, all of which are vital for materials research. I also received training in microprocessor technology (Arduino, Raspberry Pi) and gained extensive experience in the operation of mechanical tools.
  - Synthesized a material that serves as an adhesive for paper binding, contributing to the enhancement of paper recycling processes. Successfully patented a material-related invention in both the United States and India, and I had the honor of presenting this innovation at the prestigious Lemelson Student Prize event at MIT, demonstrating my dedication to advancing the field of materials science.

*Received letter of appreciation and PPA from Cooper Union Edu. New York*  
*Indian Patent Application No- 202221043097 USA Patent Application No -63438506 CPA - Dr. Alan Wolf*

## RESEARCH EXPERIENCE

- **Computational Insights into Modulating the Performance of Mxene Based Electrocatalyst**  
*Bachelor Thesis - Heterostructure Electrocatalysts for HER reaction Prof. Dibyajyoti Ghosh  Jul - Dec '23*
  - Authored a review article that discussed the merits of MXenes in comparison to NPM electrocatalysts.
  - Conducted computational analyses of adsorption energies for potential active sites on MXenes using Density Functional Theory (DFT), ultimately identifying the most reactive site for the Hydrogen Evolution Reaction (HER). To assess electronic properties, generated electronic band structures for various MXenes employing the band structure functionalities within vaspkit. The outcomes of my investigations revealed the metallic nature of the MXene structure.
  - Modeled MXenes with halogen functional groups ( $Ti_3C_2F_2$ ,  $Ti_3C_2Cl_2$ ,  $Ti_3C_2Br_2$ ,  $Ti_3C_2I_2$ ). Enhanced the efficiency of MXenes as electrocatalyst through these modifications and results shows that the  $\Delta G_H = 0.01$  which is much closer to Pt.
  - Tuned properties with creating high entropy MXenes. Currently working on high entropy MXenes results.
  - All calculations are done using pseudo-potential potpaw-PBE-54, KPOINTS generated from vaspkit (9 x 9 x 1) for SCF and (4 x 4 x 1) for force optimisation, and DFT-D3 for vDW corrections.
- **Computational Study of the Performance of Ni-rich Layered Oxide for Lithium-Ion Batteries**  
*Self Project  Jan '23- May '23*
  - Presented a pseudo-mesoscale finite element model developed with COMSOL Multiphysics software that describes the effect of the structural properties of the positive electrode, which is  $LiNi_{0.6}Mn_{0.2}Co_{0.2}O_2$  (NMC 622), on the performance of the LIBs with lithium metal anode.
- **A Deep Learning Approach to Estimate Stress Distribution on Biomaterials**  
*APL405, Machine Learning in Mechanics Prof. Sitikantha Roy  Jul- Nov '22*
  - Estimated stress on materials using supervised learning demonstrating its feasibility over **FEA** approach. Deployed CNN with Prewitt Operator to calculate strain to satisfy static equilibrium analysis of stress. Encoded and decoded data by implementing unsupervised learning using PCA and SVD to reduce computation costs. Achieved remarkable AME and AE values of approximately 1.8 and 1.6 and generated a comprehensive report using LaTeX. 

- **Molecular Dynamics Simulations of  $WS_2$  Using SW Potential**

Winter Research Project Prof. Dibyajyoti Ghosh 

Sept'23 - present

- Tested the performance of the Stillinger - Weber (SW) potential in modeling the properties of  $WS_2$  by conducting Molecular Dynamics simulations using LAMMPS.
- Calculated the geometric properties, cohesive energy, Young's modulus, and poisson ratio for two system sizes and compared them with known experimental and DFT calculations.
- Visualized and analyzed the tensile deformation simulation results using Ovito.

- **Superhydrophobic Brass Surface with Fabricated via Micro-Etching**

Winter Research Project - Advancing Superhydrophobicity on Brass Prof. Lakshmi Narayana 

Nov-Jan '21

- Made a superhydrophobic brass surface using solution immersion & chemical leaching method. The increase in the contact angle of the brass substrate by fabrication via micro-etching followed by modifications using **STA**. The resulting contact angle was  $155^\circ$  which is superhydrophobic in nature.
- Used SEM for & characterization tools for morphological micro-nanostructural analysis of substrate. The CAs for water were measured using the sessile drop method. The chemical composition was analyzed using XPS and XRD (Bruke D8 Advance).

- **Materials Science Curriculum Laboratories:**

- **Functionals Materials Lab**

- \* Preparation & Characterization of transparent conducting oxides. Experimented with the ferroelectric properties of  $BaTiO_3$ . Designed **Liquid Crystal Thermometer** in the lab.

- **Corrosion Testing Lab**

- \* Experimented with Pitting, Crevice, and Catalytic corrosion on Mg, Al, and steel alloy. Computed corrosion rates in various environmental conditions using CHESTA. Coupling electrodes.

- **Materials Selections & Characterization Lab**


- \* Designed materials with multiple constraints and objectives. Experimented with TEM, SEM, AFM, XPS, XRD, FTIR, UV-Vis Spectroscopy, and CA characterization.

- **Mechanical Behaviour of Materials Lab**

- \* Experimented Tensile, Hardness, and Creep tests on polymers, metals, and alloys.

PROJECTS (Other Core Material and Technical Projects)

- **Homogeneous Crystal Nucleation In Binary Metallic Melts**

MLL103 Thermodynamics Course Term Paper, Prof. Ankur Goswami 

Aug-Nov '21

- Proposed a quantification method for homogeneous nucleation frequency as a function of the liquid composition and temperature, using the predictions of nucleation theory. The free energy of crystallization is generated using normal solution models for the liquid&solid. It is used to compute the interfacial tension with model-based estimates. As input, thermodynamic quantities are used.

- **Restructuring the OCS Portal** Office of Career Services

Aug'21 -Nov '23

- Improved the workflow of placement activities by designing modules for auto-mailing, real-time notifications, and archives (2023). Designed an Autonomous Query Management System for student queries resolved by staff with a convenient UI to manage queries (2022).
- Simplified recruiter registration; Re-engineered the whole DB structure and codebase to support multiple sessions (2021)

- **CoWin Booking Tool** Indian Live Vaccine Booking

May'21 - Jun'21

- Implemented a portal with a more accessible and user-friendly UI for booking vaccine slots using the CoWIN public API. Helped 25K+ users find and book slots with easy-to-use interface designed with optimized for mobile devices.
- Used public CoWin API, Bootstrap, and simple web-development tools to reduce computation expenditure.

- **Data Structures and Algorithms** Prof. Amit Kumar Open Source Code

Jul'21 - Nov'21

- Organizational Hierarchy: Implemented an efficient hierarchy using AVL rotation, search tree, and generic nodes, facilitating seamless operations. Received positive feedback for automating processes, improving productivity, and streamlining operations in  $O(\log(n))$  run time.
- Restaurant Simulation (McMahon's Burgers): Created a restaurant simulation system, managing customer states (e.g., arrival time, order receiving time, billing queue index). Simulated each event in logarithmic time by implementing heaps, queues, AVL Trees, and growable arrays (vectors).

## KEY COURSES

Electromagnetic Waves& Quantum Mechanics (PYL101)	Deep Learning in Solid Mechanics (APL405)
Density Functional Theory (Coursera)	Semiconductor Specialization (Coursera)
Intro. to Electrical Engineering (ELL101)	Advance Chemistry (CML101)
Numerical Methods & Computation (MTL107)	Thermodynamics of Materials (MLL103)
Characterization of Materials (MLL104)	Math. Methods in Materials Eng (MLL212)
Mechanical Behaviour of Materials (MLL251)	Electronic Optical & Magnetics Properties of Materials (MLL213)
Materials Processing (MLL371)	Materials Modelling (MLL213)
Corrosion & Degradation of Materials (MLL452)	Materials Selections & Design (MLL372)
Nanostructures and Nanomaterials (MLL740)	Transport Phenomenon (CLL110)

## POSITIONS OF RESPONSIBILITY

- **Technical Overall Coordinator, Offices of Career Services, IITD** (Sept 2021 - Present):
  - \* Managing a team of 4 staff, 2 coordinators, 2 technical members & 3 executives to develop the OCS portal, which is currently being used by **10000+** students and **1000+** recruiters.
  - \* Introduced numerous fresh initiatives to streamline the procedure. Maintained IIT Delhi's server system for two years. Hired a fresh team to carry on the work heritage.*Awarded **Best Contribution (2022)** and **Significant Contribution (2023)** by Senate.*
- **Convener : Department of Materials Science & Engineering** (March 2023 - Present):
  - \* Elected via democratic means from the department. Managed a team of 3 conveners from fresher, sophomore, and junior bat.
  - \* Managing academic administrative concerns for 120+ students. Actively addressed potential issues within the branch, collaborating with faculty and students to develop effective solutions.
- **Coordinator, Board of Sports Activities** (May 2022 - April 2023):
  - \* Led a 3-tier team with 20+ executives. Spearheaded the organization of the sports fest (**INTER-IIT**) spanning over 15 days with all 13 sports being played after a gap of many years. Introduced LIVE scoring & informal events in 10+ sports.
- **Academic Mentor, Board for Student Welfare** (May 2022 - Dec 2022):
  - \* Mentoring **20+ freshmen** in their classes to help them adjust to the new IIT academic culture.

## TECHNICAL SKILLS

- **Experimental:** VASP, LAMMPS, UV-vis spectroscopy, Glovebox, XRD, SEM, FTIR
- **Languages:** Python, C++, Bash, SML, SQL, Node.js, Matlab, Java, Latex
- **ML/AI Libraries:** PyTorch, Tensorflow, Keras, Matplotlib, Numpy, Flask
- **Tools:** Linux, Git, HPC, OpenMP, MPI, Angular, Android Studio, Firebase, Apache

## EXTRA CURRICULAR ACTIVITIES

- **Outstanding Contribution to Office of Career Services** award from **Dean Academics, IITD**.
- **Significant Contribution to Sports Activities** award from **Warden Satpura House, IITD**.
- **Aquatics Captain** (Jun 2022 - May 2023): Managed swim team activities, coordinating training sessions, representing the team in competitions & events. **Team won the silver in INTER-IIT**.
- **Athletics Vice Captain** (Jun 2021 - May 2022)
  - \* Won **Silver Medal in 200m** event in Sportech the Institute Annual Sports Fest ( Aug 2022)
  - \* Won **gold medal in 100m** event in Athletics Premium League (Jun 2021)
  - \* Won **gold medal in 4\*4 100m relay** in Athletics Premium League (Jun 2021)
  - \* Participation in 400m, 800m event in the Annual Sports Fest Sportech 2022 IIT Delhi
- **Materials and Art Competition:** 2nd Winner, Presented memes creating skill using Materials Science concepts.
- **Micron Semiconductor Company Hackathon:** 1st Place Winner, A Champion of the Memory Optimization Hackathon, demonstrating remarkable memory optimization skills.
- **Volunteering Work:**
  - \* National Service Scheme, IIT Delhi
  - \* House Committee, Satpura House, IIT Delhi
  - \* Maintenance Committee, Satpura House, IIT Delhi