

# Krishnadev Pandey

Senior Undergraduate, Department of Materials and Metallurgical Engineering, MANIT Bhopal, India

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## Education

### Maulana Azad National Institute of Technology Bhopal

(2022 - '26)

Bachelor of Technology in Materials and Metallurgical Engineering

GPA: 7.92/10

## Research Interests

- Theory- Mechanical Behavior of Materials, Piezoelectric Materials, Semiconductor Technology
- Applications- Crystal Growth, Nanoscience, Materials Testing

## Academic Achievements and Honors

- Among the top 10% in the Department of Materials and Metallurgical Engineering (Present)
- Earned a one-year foundational certification in Programming and Data Science from IIT Madras (2024)
- Recipient of Samsung Fellowship for India Semiconductor Workforce Development Program (2025)
- Awarded the CeNSE Summer Internship and Certificate of Distinction by IISc Bengaluru for exceptional performance in the Winter School on “Semiconductor Technology” (2025)

## Research Experience

### 1) Determination of d coefficient and Poling optimization in thin film piezoelectric (May- Jul '25)

Guide: [Prof. Gayathri Pillai](#), Center for Nano Science and Engineering (CeNSE), Indian Institute of Science (IISc), Bangalore

Aim: To reduce substrate bending effects during  $d_{33}$  measurement and assess the effectiveness of AC and DC poling in enhancing the piezoelectric response of thin films

- Extracted  $d_{33}$  coefficient of AlN and PZT thin films on silicon substrates using **Laser Doppler Vibrometry (LDV)** measurements and validated results through **COMSOL Multiphysics** simulations
- Introduced a new **electrode design** enabling more accurate measurement of the  $d_{33}$  coefficient in thin film over substrate
- Performed **AC and DC poling** of thin film PZT and optimized poling conditions to enhance the  $d_{33}$  value
- Explored advanced characterization tools and techniques including **DC probe station, LDV, FE-SEM, XPS, Raman Spectroscopy** and developed understanding of fabrication processes—lithography, deposition and etching in **Class 100/1000 cleanroom** environment

### 2) Synthesis and First-Principles (DFT) Analysis of Lead Zirconate Titanate (PZT) (Jan - May '25)

Guide: [Prof. Sanjay Srivastava](#), Materials and Metallurgical Engineering Department, MANIT Bhopal

Aim: To synthesize, characterize, and perform density functional theory (DFT) calculation studies on lead zirconate titanate (PZT) pellets

- Performed synthesis using planetary ball milling process
- Characterization techniques used—XRD, SEM, Raman Spectroscopy and FTIR
- Computed band gap and density of states calculations using DFT in Materials Studio
- Currently preparing a research paper for submission based on this work

### 3) Crystal Growth of CdZnTe and Poling of PMN-PT Single Crystals

(Dec '24 - Jan '25)

Guide: [Manish Kumar Sinha, Scientist-E](#), Solid State Physics Laboratory, Defence Research and Development Organisation (DRDO), Delhi

Aim: To understand the orientation selection for Cadmium Zinc Telluride (CZT) crystal growth and effects of poling on lead magnesium niobate-lead titanate (PMN-PT) single crystals

- Conducted extensive literature survey on selecting the (111) plane for Cadmium Zinc Telluride single crystal growth
- Examined the effects of **pulsed** and **DC poling** on piezoelectric PMN-PT single crystals
- Analyzed binary and ternary phase diagram using **Thermo-calc** software

## Selected Technical Projects

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### 1) Mathematical Relation Between Compressive Yield Strength and Hardness (Jan-Apr '24)

Guide: *Prof. C Sasikumar, Materials and Metallurgical Engineering Department, MANIT Bhopal*

- Led a six-member team to establish a mathematical relationship between compressive yield strength and hardness for different aluminium samples
  - Utilized **Origin** software for data analysis and curve plotting
  - Conducted experiment using the **Universal Testing Machine** and **Brinell Hardness Testing Machine**
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### 2) Corrosion Behavior of Mild Steel under Various Environmental Conditions (Jul-Nov '24)

Guide: *Prof. Ramesh Kumar Nayak, Materials and Metallurgical Engineering Department, MANIT Bhopal*

- Investigated the effect of **different media** (HCl, HNO<sub>3</sub>, salt spray, tap water, environment chamber, soil) and varying exposure time and temperature on the corrosion rate of mild steel
  - Examined the **type of corrosion** in each sample and evaluated potential corrosion prevention methods
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### 3) Hydrogen Embrittlement in Dissimilar Material Joints (Sep-Oct '24)

Guide: *Prof. Ramkishor Anant, Materials and Metallurgical Engineering Department, MANIT Bhopal*

- Developed framework to understand hydrogen embrittlement in dissimilar material joints
  - Studied various modeling techniques: **Phase-Field Modeling**, **Scale-Bridging Modeling**, and **Multiscale Modeling**
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## Industrial Training

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### Vocational Trainee at Steel Authority of India Limited

(Jul '24)

*Bhilai Steel Plant, Steel Authority of India Limited (SAIL)*

- Completed two-week vocational training at blast furnace, plate mill, coke oven, and sinter plant
  - Gained exposure to the integrated steel plant operations to understand the processes involved in iron extraction from ore, its conversion into various steel grades and production of commercial goods
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## Extracurricular Activities

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- Organized a Short Term Training Programme (STTP) on "AI/ML In Computational Material Science"
  - Studied Sanskrit language for 3 years as a subject in secondary school
  - Active member of Indian Institute of Metals (IIM) and Institute of Corrosion (UK), engaging with national and international research communities in materials science
  - Secured 2nd position in an inter-school mixed sports competition (chess, cricket, and badminton) among 8 teams
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## Relevant Coursework & Technical Skills

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**Materials Engineering** Physical Metallurgy, Mechanical behavior of Materials, Materials Characterization, Corrosion Science, Welding, Casting and Solidification, Iron and Steel Making, Composite Materials, Ceramic Science, Destructive and Non-Destructive Testing

**Mathematics** Linear Algebra, Calculus, Complex Analysis, Differential Equations, Numerical Analysis, Linear Programming

**Languages & Tools** Python, Origin, Thermo-Calc, VESTA, Materials Studio, COMSOL Multiphysics

## References

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### Prof. C Sasikumar

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