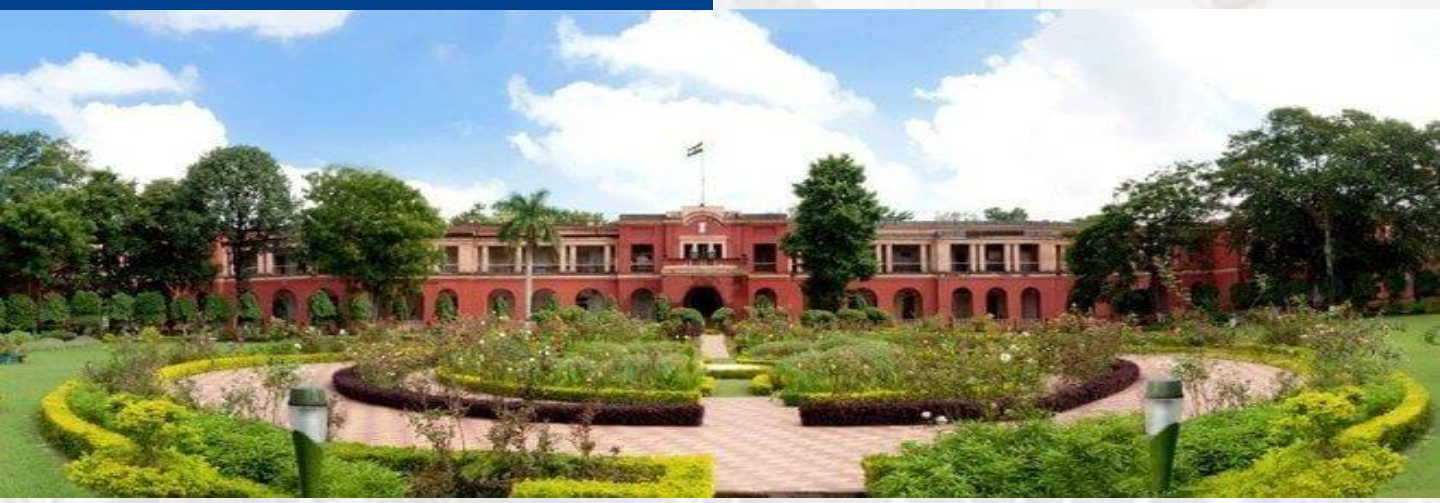
भारतीय प्रौद्योगिकी संस्थान
भारतीय खनि विद्यापीठ
धनबाद
IIT ISM
INDIAN INSTITUTE OF TECHNOLOGY
INDIAN SCHOOL OF MINES
DHANBAD

# FMME OreBits

Fuel Minerals and Metallurgical Engineering
Monthly Newsletter
Vol. 5, January 2025



## From HoD's Desk

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*Dear Readers,*

*The fifth edition of our department's monthly newsletter marks a significant milestone as we continue to thrive in our three core verticals: Fuel, Minerals, and Metallurgical Engineering. Our department's research endeavors are intricately aligned with the nation's aspirations, focusing on the processing of critical minerals, pioneering technologies for harnessing alternative energy resources, advanced methodologies in iron and steel processing, the exploration of non-ferrous metals, the integration of AI and ML into our practices, and innovative equipment design.*

*The FMME Department celebrated a remarkable January by participating in the Annual R&D fair. The faculty members and the research scholars of the department took active part in international conferences. Some faculty members received project relating extraction of critical minerals for sustainable development from Ministry of Mines.*

# Farewell to Prof. S. Bhattacharya

It was both an honor and a bittersweet moment as we bid farewell to a truly remarkable individual—Prof. S. Bhattacharya. After years of dedication, wisdom, and inspiration, it is time for him to turn the page to a new chapter in life. Prof. Bhattacharya has been more than just a professor; he has been a mentor, a guide, and a source of unwavering support for countless students and colleagues.

On behalf of everyone here, I want to express our deepest gratitude for his years of service and dedication. We wish you a retirement filled with happiness, good health, and the fulfillment of all his dreams. Thank you, and best wishes for the journey ahead.

# WORKSHOPS

**Prof. Shravan Kumar** delivered a lecture in the workshop on "SUSTAINABILITY IN COAL BENEFICIATION: CHALLENGES AND OPPORTUNITIES" on 29th January 2025 organized by CIMFR, Digwadih Campus, Dhanbad.

He was honored with a token of appreciation by **Prof. D. D. Mishra**, Ex HoD of our department and Ex-Chairman of BoG, IIT (ISM) Dhanbad.

# Invited Talks in International Seminar on Screening and Sizing (i3S)


*Prof. Shravan Kumar chaired a technical session in the International seminar on screening and sizing (i3S) organized by Tata Steel Jamshedpur on 16th and 17th January 2025. Prof. Nikkam Suresh also attended the seminar and presented a technical paper.*


*In the same conference i3S, the students* ***(Mr. Samala Sai Kiran and Mr. Rahul Raj)*** *from FMME department actively participated and stood runner-up in the poster presentation.*

# BIS Workshop

A successful two-day event on awareness of the application of **Bureau of Indian Standards (BIS)** was conducted in the Department of Fuel Mineral and Metallurgical Engineering on 30-31st January 2025 which was attended by a good number of students and faculty members of the department. The lectures were taken by **Mr. Manodip Bag,** Jt. Director, Bureau of Indian Standards covering lectures on the

1. Application of Ferrous and Non-Ferrous Metals and
2. Chemical Testing of Metals.

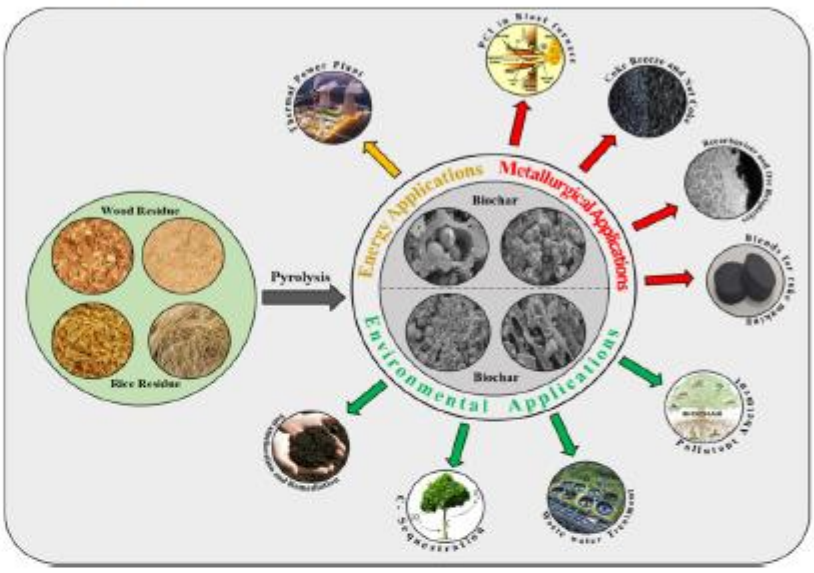
# RESEARCH & DEVELOPMENT FAIR

## FUEL AND ENERGY ENGINEERING

### Characterization of biomass and biochar for their potential in various energy and environmental applications

Dr. Amrit Anand, Prof Shalini Gautam

Biochar can be used in various diversified areas, including energy production, iron-making, production of chemicals and valuable products. The contribution of biomass has been estimated as energy crops (22–1,272 EJ), agricultural residues (10–66 EJ), forestry residues (3–35 EJ), wastes (12–120 EJ), and forestry (60–230 EJ). The present study evaluates the characteristics of biochars for numerous energy and environmental usages.

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### Development and Standardization of Biochar and By-products for Application in the Indian Iron & Steel Industry

PI: Prof Shalini Gautam; Value: **600.11 Lakhs**; Sponsored by: Sentra.world

In India, there is huge crisis of Prime coking coal, which is fulfilled by Importing the coal and The availability of surplus biomass from is assessed as 245 Mt in 2020–21 and 261 Mt in 2030–31. So this study focused on the utilisation of indigenous coal and biochar for biocoke making, which can be renewable, sustainable and promising alternative fuel to solve themetallurgical coal crisis

# MINERAL ENGINEERING

**Jain Mineral Separator** (JMS) is a continuous mineral concentrator that separates fine-heavy valuable minerals from light, non-valuable tailings. The lab scale unit operates at a capacity of 10 kg/hr and may be scaled up to treat up to 2tph of fine-sized minerals.

It is the first mineral processing equipment developed in India. The patent application is in process.

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1.5m **Drum Scrubber** (Batch and continuous) is a custom-designed mineral washer used to remove slime/clay coating from valuable minerals such as iron ore.

**Bond's Work Index rod mill** with automatic inclination control is first of its kind rod mill that is designed to estimate Rod Mill Index for ores based on Bond's theory

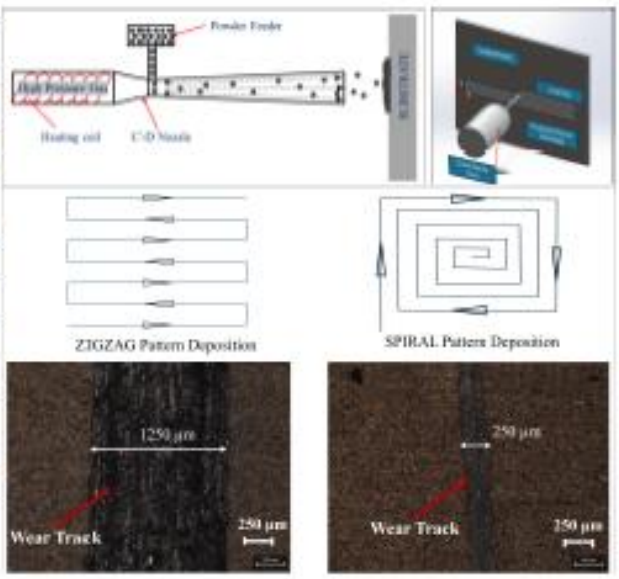
Unique facilities developed and available at Mineral Engineering Lab

# METALLURGICAL ENGINEERING

**Wear Resistance Improvement for Cold Spray Coatings by Optimizing Toolpath Strategies**

Dr. Chaitanya Gullipalli, Prof Kesavan Ravi

Cold spray is a coating technique that is capable of depositing dense and defect-free functional (corrosion, wear resistance) coatings. Al + Al2O3 coatings offer low wear resistance despite being a great solution to corrosion. The present work addressed this issue by employing a novel toolpath strategy in a cold spray of Al + Al2O3 coating, which resulted in a 90 % reduction in volume loss during the wear test.

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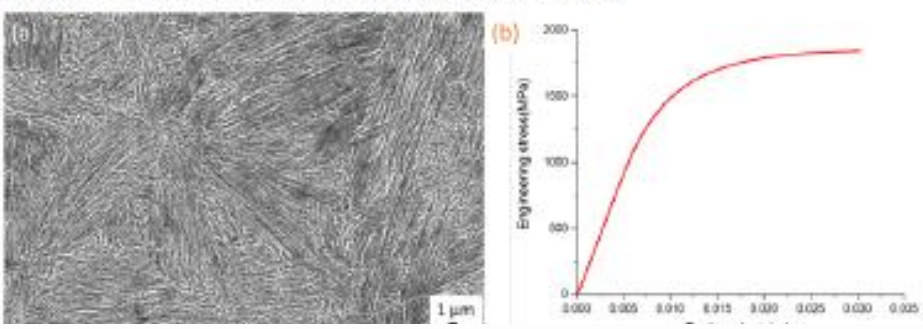
**Design and Development of Abrasion Resistant Alloys for Sustainable Mining Operations**

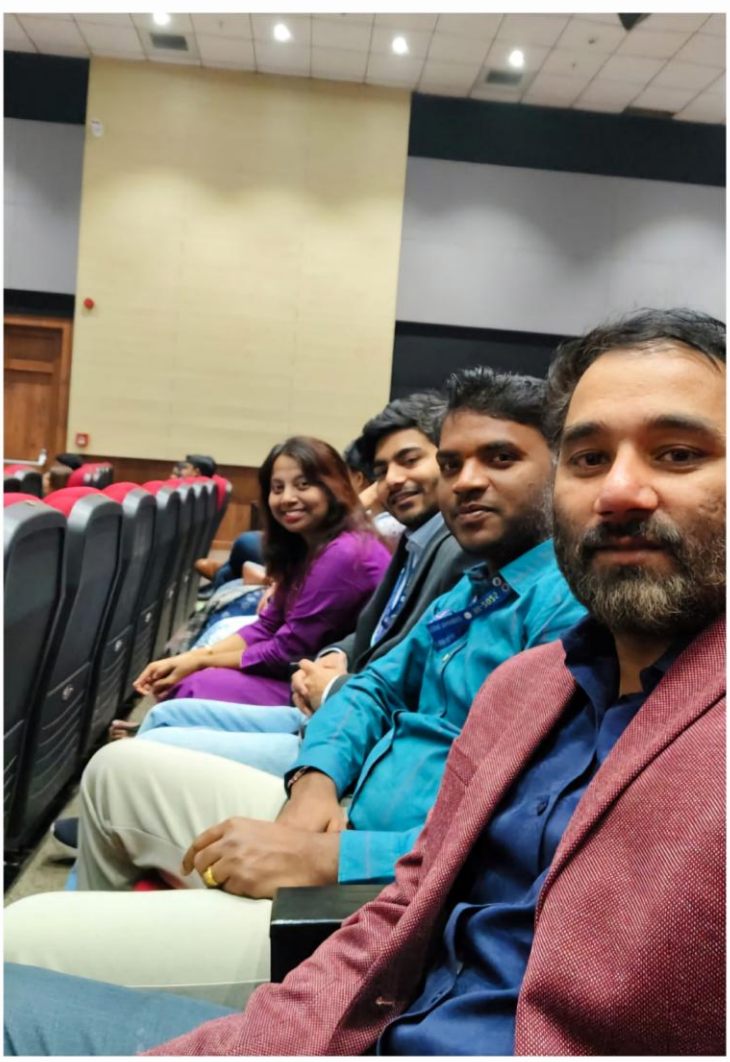
PI: Prof Avanish Kumar, Value: **26.08 Lakhs**, Sponsored by: Ministry of Mines

**Research work**: Development of nano-structured steels of yield strength above 1.5 GPa

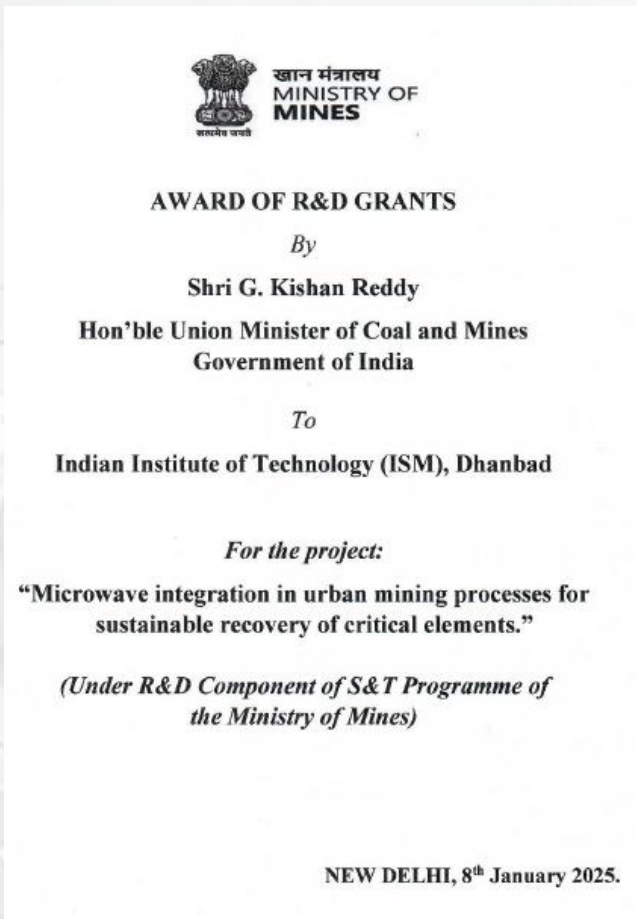
The research group has been developing ultra-high-strength steels for railways and other wear-resistant applications. A clean carbide-free nanostructured bainitic steel having an average grain size of less than 100 nm demonstrated a yield strength above 1.5 GPa.







# Projects



खान मंत्रालय
MINISTRY OF
MINES

**AWARD OF R&D GRANTS**

*By*

**Shri G. Kishan Reddy**

**Hon'ble Union Minister of Coal and Mines**
**Government of India**

*To*

**Indian Institute of Technology (ISM), Dhanbad**

***For the project:***

**"Microwave integration in urban mining processes for sustainable recovery of critical elements."**

***(Under R&D Component of S&T Programme of the Ministry of Mines)***

**NEW DELHI, 8th January 2025.**

Dr. Aarti Kumari and Dr. M. Vishnu Teja attended "CHINTAN SHIVIR" on 08.01.2025 at Vigyan Bhawan, New Delhi organized by the Ministry of Mines. The meeting was organized to bring together experts, stakeholders, and innovators to develop actionable reforms in the mining sector. They attended different brainstorming sessions on "Circular economy, Mineral exploration and production, development of local ecosystem of mining equipment manufacturing etc.

In Chintan Shivir, the administrative approval letter has been received by Dr. Aarti Kumari (PI) and Dr. M. Vishnu Teja (Co-PI) for our project entitled "Microwave integration in urban mining processes for sustainable recovery of critical elements" by Shri G. Kishan Reddy, Hon'ble Union Minister of Coal and Mines on 08.01.2025.
Total Project Cost: Rs. 40,75,270/-
Time: 2 year duration.

# NEW Member in the department

**About Dr. Vivek Kumar Sahu**

He recently joined as an assistant professor in the Department of Fuel, Minerals and Metallurgical Engineering at IIT-ISM Dhanbad, Jharkhand. Prior to this, he was a postdoctoral researcher in the Department of Mechanical Engineering at University of North Texas (UNT) from March 2024, where he worked on a U.S. Department of Defense-funded project titled "High-throughput Screening and Quality Assessment Testing and an AI-based In-Situ Process Monitoring and Quality Control Framework for Additive Manufacturing New Builds and Repaired Parts".

# PUBLICATIONS

1. Imkong Rathi & **Shravan Kumar**: Innovative study on chalcopyrite flotation efficiency with xanthate and ester collectors blend using response surface methodology (B.B.D): towards sustainability, Scintific reports, 2025, 15-65, https://doi.org/10.1038/541598-024-81193-5

2. Sudharm Rathore, **Avanish Kumar,** Anurag Kumar, Kushal Mishra, Aparna Singh: *Prediction of sub-critical fatigue crack growth rate in a high-carbon tempered martensitic steel at varying R ratio: experimental investigation and machine learning based modelling*. International Journal of Fatigue 193 (2025) 108804. Q1, IF – 5.7, *DoI-10.1016/j.ijfatigue.2025.108804.*

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*Stay tuned for more exciting updates in our next edition…*