DEEPAK NAYAK

SENIOR SCIENTIST

CSIR-Institute of Minerals and Materials Technology
Bhubaneswar, Odisha-751013, India

9861078942 deepak@immt.res.in

WORK EXPERIENCE

CSIR-IMMT Bhubaneswar
2019-Present

Senior Scientist
- Managed projects from concept to completion in mineral beneficiation, extraction of valuable metals, and recycling of industrial wastes.

CSIR-IMMT Bhubaneswar
2015-2019

Scientist
- Microwave-assisted reduction roasting for beneficiation of lean-grade ores.
- Energy-efficient process for TiO_2 production from ilmenite concentrate.

CSIR-IMMT Bhubaneswar
2011-2014

Quick Hire Scientist Trainee
- Development of copper-graphite-based hybrid composites by powder metallurgy and their characterization.
- Optimization of process parameters by using ANOVA so that tailor-made MMCs can be developed for intended purposes.

Jindal Stainless Limited
2010-2011

Graduate Engineer Trainee
- Maximization of chrome recovery in Electric Arc Furnace.
- Market development of stainless-steel products.

EDUCATION

IIT Bhubaneswar
2019-2023

Ph.D. in Metallurgical and Materials Engineering
Dissertation: "Pelletization, pre-reduction and smelting of low-grade ilmenite concentrate for TiO_2 slag production."

AcSIR
(CSIR-IMMT Bhubaneswar)
2011-2013

M.Tech in Material Resource Engineering
Thesis: "Development of copper-graphite-based hybrid composites by powder metallurgy and their characterization."

NIT Rourkela
2006-2010

B.Tech in Metallurgical and Materials Engineering
Project: "An attempt at optimizing the flow characteristics of blast furnace slag by investigation with synthetic slag prepared in the laboratory using pure oxides."

EXPERTISE

- Iron Ore Beneficiation
- Agglomeration & Direct Reduction
- Beach sand Processing
- Waste Utilization

PUBLICATIONS

2020 **Book**

B. C. Ray, R. K. Prusty, and D. Nayak, Phase Transformations and Heat Treatments of Steels. CRC Press.

2024 **Journal Publications**

D. Nayak, S. S. Rath, S. Pati, and P. S. De, “A Review of the Solid-State Reduction Aspects of Ilmenite for Efficient and Sustainable Production of TiO2 Slag,” Miner. Process. Extr. Metall. Rev., vol. 0, no. 0, pp. 1–20.

N. Sahu et al., “Preparation of Nickel-Bearing Chromite Overburden Pellets Suitable for DRI Production,” J. Sustain. Metall., May 2024, doi: 10.1007/s40831-024-00842-1.

J. N. Panda, D. Nayak, N. Dash, S. Angadi, and S. S. Rath, “Insight of Reduction Roasting of a Low-Grade Goethitic Indian Iron Ore in a Rotary Kiln: Process Optimization and Characterization,” Trans. Indian Inst. Met., vol. 77, no. 2, pp. 553–561.

2023 D. Nayak et al., “Pelletization of a Low-Grade Indian Chromite Overburden: Optimizing the Induration Parameters and Understanding the Consolidation Behavior,” Metall Mater Trans B, vol. 54, no. 6, pp. 3049–3059.

D. Nayak, N. Ray, N. Dash, S. S. Rath, S. Pati, and P. S. De, “An Analysis of the Influence of Drying Methods on the Drying Kinetics and Quality of Ilmenite-Coke Composite Pellets,” Trans Indian Inst Met.

D. Nayak et al., “Evaluation of VSK separation in the classification of two mineralogically different iron ore fines,” Int J Miner Metall Mater, vol. 30, no. 2, pp. 260–270.

2022 A. Dutta et al., “Corrosion behavior of AlCuFeMn alloy in aqueous sodium chloride solution,” Materials Chemistry and Physics, vol. 276, p. 125397.

2021 S. K. Roy, D. Nayak, N. Dash, and S. S. Rath, “Influence of Coal Petrography on Microwave-assisted Carbothermic Reduction Roasting of Banded Hematite Jasper Ore,” Mineral Processing and Extractive Metallurgy Review, vol. 42, no. 4, pp. 242–256.

D. Nayak, N. Ray, N. Dash, S. S. Rath, S. Pati, and P. S. De, “Induration aspects of low-grade ilmenite pellets: Optimization of oxidation parameters and characterization for direct reduction application,” Powder Technol., vol. 380, pp. 408–420.

2020 S. K. Roy, D. Nayak, N. Dash, N. Dhawan, and S. S. Rath, “Microwave-assisted reduction roasting—magnetic separation studies of two mineralogically different low-grade iron ores,” Int. J. Miner. Metall. Mater., vol. 27, no. 11, pp. 1449–1461.

D. Nayak, N. Ray, N. Dash, S. S. Rath, and S. K. Biswal, “Reduction behaviour of Odisha Sands Complex, India ilmenite-coke composite pellets,” J. Cent. South Univ., vol. 27, no. 6, pp. 1678–1690.

S. K. Roy, D. Nayak, and S. S. Rath, “A review on the enrichment of iron values of low-grade Iron ore resources using reduction roasting-magnetic separation,” Powder Technol., vol. 367, pp. 796–808.

D. Nayak, S. K. Roy, N. Dash, and S. S. Rath, “Investigation on the Coal-Based Direct

Reduction of Mill Scale Pellets: Statistical Modeling and Characterization Studies," Trans Indian Inst Met, vol. 73, no. 3, pp. 691-701.

2019 D. Nayak, N. Dash, N. Ray, and S. S. Rath, "Utilization of waste coconut shells in the reduction roasting of overburden from iron ore mines," Powder Technol., vol. 353, pp. 450–458.

2018 N. Ray, D. Nayak, N. Dash, and S. S. Rath, "Utilization of low-grade banded hematite jasper ores: recovery of iron values and production of ferrosilicon," Clean Technol. Environ. Policy, vol. 20, no. 8, pp. 1761–1771.

2014 D. Nayak and M. Debata, "Effect of composition and milling time on mechanical and wear performance of copper–graphite composites processed by powder metallurgy route," Powder Metall., vol. 57, no. 4, pp. 265–273.

D. Nayak, N. Ray, R. Sahoo, and M. Debata, "Analysis of Tribological Performance of Cu Hybrid Composites Reinforced with Graphite and TiC Using Factorial Techniques," Tribol. Trans., vol. 57, no. 5, pp. 908–918.

PROJECTS

2024 Laboratory-Scale Beneficiation and Pelletization Studies on Tailings from Kiriburu & Meghahatuburu Iron Ore Mines and Composite Samples of Both Tailings; **Principal Investigator**; SAIL

Coal Petrographic Study of some Borehole Vessel Samples; Inspectorate Griffith India Pvt. Ltd.

Characterization and Pilot-Scale Flowsheet Development for a Low-Grade Iron Ore; Praveen Chandra Group

Petrographic study of some Indian coal samples; **Co-Principal Investigator**; Inspectorate Griffith India Pvt. Ltd.

Chemical compositional study of graphite bearing sample; Directorate of Mines & Geology, Odisha

Process flowsheet development for the recovery of iron values from low-grade iron ore; Vedanta Limited, Goa

Pilot-Scale induration studies of Low-grade Chromite Overburden; **Principal Investigator**; TATA Steel

Production of Lithium from potential Indian primary resources for battery applications; CSIR

Development of fuel agglomerates from coal wastes for metallurgical applications; CSIR

2023 Characterization and Beneficiation of Iron Ore fines to develop an Iron Ore process flowsheet; Jaivinayak Mineral Resources Pvt. Ltd.

Recovery and extraction of PGE values from the low-grade PGE ores of Bangur ML of OMC Ltd.: Process Flowsheet Development, Pilot scale testing, DPR preparation; OMC Ltd.

Beneficiation studies of iron ore from Hahaladdi mines, North Bastar, Kanker, Chhattisgarh; JSW Special Products Ltd.

Beneficiation studies for iron ore processing plant of NMDC Bacheli; Takraf India Pvt. Ltd.

Study the physical and metallurgical characteristics of iron ore pellets and analysis of its suitability for iron making; BRPL

Smelting and tapping of chromite and manganese ore in arc furnace in 10 kg scale; TATA Steel

Grindability studies for high-grade nickel-lateritic ore; TATA Steel
Communition and Classification Studies on Electronic Wastes; TATA Steel
Pelletization Studies of Nickel-Rich overburden sample; **Principal Investigator**; TATA Steel
Studies on chemical characteristics of PGE ores of Bangur ML of OMC Ltd; OMC Ltd.
Development of a process flowsheet for the recovery of iron values from low-grade fines; Odisha Alloys
Pelletization and DRI studies of a low-grade overburden; **Principal Investigator**; TATA Steel
Mineralogical study of Iron ore from Koira Block, Sundergarh, Odisha; Vedanta Ltd. (ESL Steel Ltd.)

2022

Design and development of flotation column system for the recovery of monazite from IREL mineral separation plant; IREL (India) Ltd.
Characterization, Beneficiation / Desliming and palletization studies on three different Iron Ore samples (Blue dust/ High Grade flaky ore, Crushed fines & Low grade fines) of Surrjagarh Mines, Gadchiroli for developing the flowsheet of Iron ore beneficiation plant for pellet feed and pelletization plant; Lloyds Metals & Energy Ltd.
Characterization & Beneficiation studies studies on BHQ ore from Surjagarh Iron Ore Mines, Gadchiroli for developing the flow sheet of Iron ore beneficiation plant for pellet feed; Lloyds Metals & Energy Ltd.
Mineralogical characterization of bauxite ore sample; Anand Mining Corporation
Characterization and Process Flowsheet Development for the recovery of Iron values from Low-grade Ore; SMIORE
Recovery of metallic values from the discarded copper slag; Ministry of Mines
Optimization of pelletization parameters to obtain good quality pellets from lateritic ores and chromite overburden; **Principal Investigator**; TATA Steel
Bench-Scale dry beneficiation studies of the Wollastonite ore for achieving the desired product quality and yield as mentioned herein; Wolkem Industries Ltd.
Flowsheet Development for Processing of Beach Sand Minerals from Tailings of Srikakulam District, Andhara Pradesh; **Principal Investigator**; The APMDC Ltd.
Grindability studies of the nickel-lateritic ore; TATA Steel
Feasibility studies on Recovery of Iron values from a Sub-grade Iron Ore; AMNS
Process Flowsheet Development for the Recovery of Iron Values from Lean-grade BHQ Ore; Praveen Chandra Group
Pilot Scale Test Work for Beneficiation of Iron Ore Fines Samples from Dalli Mines of Bhilai Steel Plant; **Principal Investigator**; BSBK Pvt. Ltd.
Studies on improvement of lime content of the Alkali Bypass Dust; **Co-Principal Investigator**; UltraTech Cement Ltd.
Mineralogical characterization of Iron ore sample; Euro Pratik Ispat Pvt. Ltd.

2021

Process development for the recovery of tungsten values from lean grade Indian resources; Ministry of Mines
Characterization and beneficiation of Iron Values from Lean-grade BHJ Ore; Thriveni Earthmovers
Studies on the Characterisation and Beneficiation of Tensa Iron Ore Fines to develop an Iron Ore process flowsheet; **Co-Principal Investigator**; JSPL
Beneficiation of Silica Sand for Solar wafer Applications; **Co-Principal Investigator**; GSI
Characterization and Beneficiation of Low-grade Bauxite Ores from Gujrat; GSI
Preparation of iron ore pellet and pot grate study; JSPL
Process Flowsheet Development for the Beneficiation of Chromite Ores; Vedanta Ltd.

(FACOR)
VSK separator classification studies on iron ore and coal fines; **Principal Investigator**; NMDC
Development of process flowsheet for the recovery of individual heavy minerals from the mineral and plant tailings; IREL (India) Ltd.

2020

Modification in design of Microwave-assisted iron-making plant for up-scaling the process to reach 100 kg/day scale using Nagaland and allied iron ores; CSIR
Dry beneficiation studies on low-grade manganese ore fines; **Co-Principal Investigator**; TATA Steel
Magnetic Separation Studies to Recover Iron Values from Blue Dust; Telluric Engineering Pvt. Ltd.
Characterisation and beneficiation studies of bauxite ores to develop process flowsheet; Hindalco Industries Ltd.
Production of lithium from ores; CSIR
Beneficiation studies for the enrichment of manganese from the low-grade ferruginous ores; Tenova India Pvt. Ltd.

2018

Thermodynamics and kinetics study of ferruginous ilmenite reduction and smelting for production of titania slag; **Co-Principal Investigator**; CSIR

PROFESSIONAL SERVICE

2023

Convenor
Competition committee for organizing the International Women's Day Programme-2023.

Treasurer
The finance committee of the refresher coursework "FAME-2023."

Member
Organizing committee of the national conference "RAISE-2023."
Organizing committee of the CSIR-IMMT Diamond Jubilee Function.

2022

Treasurer
The finance committee of the refresher coursework "FAME-2022."

Member
Competition committee for organizing the IMMT Foundation Day-2022.
Organizing committee of the one-day webinar "FPCP-2022."
Competition committee for organizing the 81st CSIR Foundation Day.

2021

Convenor
The accounts committee of the international conference "CHEMCON-2021."

Member
Various other committees of the international conference "CHEMCON-2021."

2020

Treasurer
The finance committee of the short-term course "OFCCR-2020."

Member
Competition committee for organizing the 79th CSIR Foundation Day.

2019 **Member**
Competition committee for organizing the 78th CSIR Foundation Day.

2018 **Treasurer**
The finance committee of the refresher coursework "TAMMM-2018."

HONOURS AND AWARDS

2021 **Honour Roll**
Felicitated at the valedictory function for significant contribution to the international conference "CHEMCON-2021" by the Indian Institute of Chemical Engineers.

2019 **Honour Roll**
Felicitated at the AGBM-2019 for significant contribution to the IIM Bhubaneswar Chapter as a treasurer by the Indian Institute of Metals, Bhubaneswar Chapter.

Award
Best Poster Award (Second) presented at the international conference "MPT-2019" by the Indian Institute of Mineral Engineers.

PROFESSIONAL AFFILIATIONS

2022 **The Institution of Engineers (India)**
Member of Bhubaneswar Centre

Indian Institute of Chemical Engineers
Life Member of Bhubaneswar Chapter

2016-2019 **The Indian Institute of Metals**
Treasurer of Bhubaneswar Chapter

2016 **Indian Institute of Mineral Engineers**
Life Member of Bhubaneswar Chapter

The Indian Institute of Metals
Life Member of Bhubaneswar Chapter