CV of Kali Sanjay

Name	Dr. Kali Sanjay
Date of Birth	08-08-1969
Affiliation	CSIR-Institute of Minerals and Materials Technology (IMMT), Bhubaneswar-751013
Academic Qualifications	Ph.D (Materials & Metallurgical Engineering)-IIT Kanpur M. Tech (Industrial Metallurgy)-IIT Madras B. Tech (Mechanical Engineering) - Nagarjuna University, AP
Research Areas	Recycling of metals, Electrometallurgy, Electroremediation, Mathematical Modeling and Computational Fluid Dynamics, Design of Hydro & Electrometallurgical unit operations

Experience: Dr. Kali Sanjay has thirty-two years of experience in extractive metallurgy, specializing in process flow-sheet development for recovering non-ferrous metals from low-grade ores and secondaries. His expertise extends to the design and scale-up of hydrometallurgical plants, solid waste remediation, utilization of industrial effluents, and computational fluid dynamics. Since 2011, he has been a Professor in the Faculty of Engineering Sciences at CSIR-IMMT, Bhubaneswar, under the Academy of Scientific and Innovative Research (AcSIR). He teaches a postgraduate course on 'Recycling of Material Resources' and supervises M.Tech and Ph.D. thesis works.

National Committees

1. Chairperson, Ores and Feed Stock for Aluminium Industry, its Metals/ Alloys and Products, MTD-7, BUREAU OF INDIAN STANDARDS (BIS), India
2. Member, Panel to review the working draft on "Guidelines for ordering, testing and acceptance of processed copper and copper alloy scrap", BUREAU OF INDIAN STANDARDS (BIS), India
3. Member, NITI Aayog working group on Nickel and Cobalt.
4. Member, NITI Aayog committee on Critical & Strategic Minerals

Membership in Professional Societies / Institutions

1. Chartered Engineer (India), Metallurgical & Materials Engineering Division (F- 1282359)
2. Fellow, The Institute of Engineers, India
3. Fellow, National Environmental Science Academy, India
4. Life Member, Indian Institute of Metals, India
5. Life Member, Indian Institute of Mineral Engineers, India
6. Life Member, Indian Institute of Chemical Engineers, India

Address for communication

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Invited talks abroad

1. 'Electrochemical fencing of heavy metals from industrial wastes to mitigate groundwater contamination: Experiments and mathematical modeling'; Utrecht University, The Netherlands 20th July 2011.
2. 'Recovery of Mn as EMD from secondary resources' at Korea Institute of Geosciences and Mineral resources (KIGAM), Daejeon, South Korea on 9th Oct. 2012.
3. 'Ionic liquids for metals recovery through Extraction-Electrodeposition' at the Dept. of Metallurgical Engineering, Pukyong National University, Busan, South Korea on 11th October 2012.
4. 'Metallurgical processing of polymetallic nodules–Indian perspective' at the workshop on 'Processing Technologies, Metal Recoveries & Economic Feasibility of Deep Sea Mining,' 3rd October 2018, Poland, organized by International Seabed Authority.
5. 'Recovery of non-ferrous metals from low-grade ores and secondaries' at Korea Institute of Geosciences and Mineral Resources (KIGAM), Daejeon, South Korea on 26th July, 2023.
6. 'Energy Materials from Secondary Resources' at the Mathematics and Statistics, Chemistry, and Physics School in Murdoch University, Perth, Australia, on 17th June 2024.
7. 'CSIR IMMT Efforts on Critical Minerals.' at CSIRO, Perth on 18th June 2024.
8. 'Exploring CSIR-India Expertise and Opportunities in Indo-Australia Critical Minerals Collaboration.' at the University of South Australia, Adelaide, on 20th June 2024.
9. 'Critical Metals Technological Advancements at CSIR IMMT,' at CSIRO, Melbourne, on 24th June 2024.
10. 'Development of Process Technologies for Critical Metals.' at Royal Melbourne Institute of Technology (RMIT) University, Melbourne on 25th June 2024.

Books / Book chapters

1. 'Polymetallic Nodules'; Proceedings of National Seminar on Polymetallic Nodules, Editors: Shashi Anand and Kali Sanjay, 2005.
2. Book chapter on 'Aqueous Electrodeposition of Non-Ferrous Metals,' Tondepu Subbaiah and Kali Sanjay in 'Electrodeposition: Properties, Processes, and Applications,' Nova Science Publishers, Inc. ISBN-10: 1614708266 & ISBN-13: 978-1614708261, 2011.
3. Book chapter on 'Arsenic Removal from Industrial Effluents through Ferric Arsenate Precipitation' in 'Environmental Science and Engineering, Vol. 4: Water Pollution & Waste Water Treatment,' Barsha Dash, Geetanjali Mishra, Kali Sanjay, and Tondepu Subbaiah, Pages 354-363, Editor of Volume Dr. J C Singhal, Chief Editor Dr. Bhola R Gurjar, Executive Editor Dr. J.N. Govil, Publisher Studium Press LLC, USA, ISBN of Series 1-62699-088-3, ISBN of Volume 1-62699-092-, 2017.
4. Book Chapter on 'Kaolin: An Alternate Resource of Alumina' in 'Sustainable Chemical, Mineral, and Material Processing. Lecture Notes in Mechanical Engineering,' Routray, S., Dash, B., Sheik, A.R., Sarangi, C.K., Sanjay, K., Editor Chinthapudi, E., Basu, S., Thorat, B.N., Springer, Singapore. https://doi.org/10.1007/978-981-19-7264-5_10, 135-144, 2022.
5. Book Chapter on 'Considerations for Using Polymetallic Nodules as Alternative Metal Extraction Resource: Focus on Energy-Related Applications' in 'Deep-Sea Mining and the Water Column,' P. K. Sen and K. Sanjay, Editor Rahul Sharma. Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-59060-3_5, 129-164, 2024.

Awards

- Received fourth prize (Rs One lakh prize) in the 'Grand fly ash utilization challenge' contest conducted by NTPC during 2018-19.
- NESA Fellowship of the Year Award 2021 during 2021-22.
- Eminent Engineering Personality Award by The Institution of Engineers India (IEI) during 2022- 23.

Patents

International

1. A process for extraction of nickel from low grade chromite ore (International Patent Numbers: European Patent (EP1697549 B1); Australian Patent (AU 2002348824 B2); Indian patent (234452 (0483/DEL/2003)).
2. An electrochemical system and process for the reduction of nitric acid concentration using electrolytic cell (Patent File No. 3198/DEL/2012; US 20150291451 A1; WO 2014057505 A4).
3. Hydrometallurgical process for the recovery of tellurium from high lead bearing copper refinery anode slime. (Paten File No: 2459DEL2013; US Patent App. US20150053572 A1).

Indian

1. A process for production of crystalline boehmite by precipitating from supersaturated sodium aluminate liquor under atmospheric conditions at a temperature as low as 50^0C (Patent No. 267384 Dated 28/07/2015).
2. A pyro-hydrometallurgical process for the recovery of alumina and calcium silicate from flyash (Patent No. 344358 Dated 18th August, 2020).
3. Multi-helical reactor for liquid-liquid extraction / stripping and phase separation and methods thereof (Patent No. 423720 Dated 1st March 2023).
4. A process for selective separation of metals from ore (Patent No: 550768 Dated 1st October, 2024)

Recent Publications
(https://scholar.google.co.in/citations?user=3MhEeZAAAAAJ&hl=en)

1. Comparative Leaching of Rare Earth Elements from Roasted and Unroasted End-of-Life HDDs Magnet and Kinetic Study Using Hydrochloric Acid. Prasanjit Das, Abdul Rauf Sheik, **Kali Sanjay**, Niharbala Devi. *Environmental Quality Management*, Vol 35, no 2 p e70244, December, 2025.
2. Liquid-liquid extraction of Nd (III) using [P66614][Cy272] ionic liquid. Das Prasanjit, **Kali Sanjay**, Devi Niharbala. *Journal of Metals, Materials and Minerals* Vol. 35. No. 2 p e2252-e2252, Aug. 2025.
3. Solvoleaching Approach for $SmCo_5$ Alloy Scrap and Production of Sodium Samarium Sulfate and Cobalt Oxide. Prasanjit Das, Binapani Behera, **Kali Sanjay**, Niharbala Devi. *Journal of Alloys and Compounds* Volume 1035, p 181469, 5 July 2025.
4. Graphitic carbon nitride loaded $Bi_4O_5I_2$ for elevated photocatalytic tetracycline degradation. Subhasish Mishra, Barsha Marandi, **Kali Sanjay**, Rashmi Acharya, J Met

Mater Miner, vol. 35, no. 2, p. e2261, May 2025.

5. A Novel Process for Preparing Aluminium Fluoride from Coal Fly Ash Using Hydrofluorosilicic Acid Leaching and Seeding Techniques. Tripathy, Anil Kumar, Sayani Adhikari, Bankim C. Tripathy, **Kali Sanjay**, and Indra N. Bhattacharya. *Journal of Sustainable Metallurgy*, 1-13, 2025.
6. Recovery of iron as hematite and separation of trivalent lanthanide ions from spent hard disk magnet leach liquor using [P66614][Cy272] ionic liquid. Prasanjit Das, Binapani Behera, **Kali Sanjay**, and Niharbala Devi. *RSC Advances*, Volume 15(2), 912-923, 2025.
7. Designing g-C_3N_4/$NiFe_2O_4$ S-scheme heterojunctions for efficient photocatalytic degradation of Rhodamine B and tetracycline hydrochloride. Subhasish Mishra, Lopamudra Acharya, S Sharmila, **Kali Sanjay**, and Rashmi Acharya. *Applied Surface Science Advances*, Volume 24, 100647, 2024.
8. Liquid-liquid extraction and separation of light and heavy rare earth elements from chloride solution using a mixture of tertiary amine and phosphinic acid: recycling strategies for NdFeB magnet. Prasanjit Das, Abdul Rauf Sheik, **Kali Sanjay**, and Niharbala Devi. *Geosystem Engineering*, 1-11, 2024.
9. Insight into Cu Extraction Using Deep Eutectic Solvent: Reaction Mechanism. Sonidarsani Routray, Binapani Behera, Barsha Marandi, **K. Sanjay**, M. K. Ghosh, and Barsha Dash. *Metallurgical and Materials Transactions B*, 1-8, 2024.
10. Anoxic Manganese Bioleaching–Investigation of Scale-up Parameters in a Stirred Bioreactor. Tejaswini Das, V. Aishvarya, N. Pradhan, **K. Sanjay**. *Geomicrobiology Journal*, 41(9), 939-946, 2024.
11. Boosted photocatalytic accomplishment of 3D/2D hierarchical structured $Bi_4O_5I_2$/g-C_3N_4 pn type direct Z-scheme heterojunction towards synchronous elimination of Cr (VI) and tetracycline. Subhasish Mishra, Lopamudra Acharya, Barsha Marandi, **Kali Sanjay,** and Rashmi Acharya. *Diamond and Related Materials*, Volume 142, 110834, 2024.
12. Recovery of Tellurium from Waste Anode Slime Containing High Copper and High Tellurium of Copper Refineries. Sarangi, Chinmaya Kumar, Abdul Rauf Sheik, Barsha Marandi, Vijetha Ponnam, Malay Kumar Ghosh, **Kali Sanjay**, Manickam Minakshi, and Tondepu Subbaiah. *Sustainability*, no. 15, 11919, 2023.
13. Towards Solving the Complexity Associated with Continuous Countercurrent Decantation (CCD) System in Solid-Liquid Separation Processes. Tripathy, A.K., Behera, S.S., Marandi, B., Sahu, P., Sheik, A.R., Aishvarya, V., Bhattacharya, I.N. and **Sanjay, K.,** *Journal of The Institution of Engineers (India): Series D*, (https://doi.org/10.1007/s40033-023-00533-3), 2023.
14. High pure Co(II) precursor liquor from spent catalyst leach liquor. R Samal, S Mahalik, S Routroy, **K Sanjay**, B Dash, *Journal of Sustainable Metallurgy,* 2023.
15. Photocatalytic degradation of malachite green using TiO2 and ZnO impregnated on fecal sludge derived biochar. N Tiwari, S Chakrabortty, K Samal, S Moulick, BG Mohapatra, S Samanta, PK Mohapatra, **K Sanjay**, J Nayak, S Banerjee, SK Tripathy, *Journal of the Taiwan Institute of Chemical Engineers,* Volume 145, 104800, 2023.
16. Extensive investigation on extraction behaviour of organo-phosphrous based bi-functional ionic liquids for separation of molybdenum (Mo) from spent Co-Mo/Al2O3 leach liquor. S Mohapatra, SS Behera, S Tripathy, PK Parhi, **K Sanjay**, *Journal of Molecular Liquids*, Volume 366, 120087, 2022.
17. Facile synthesis, characterization and application of magnetic Fe3O4-coir pith composites for the removal of methyl violet from aqueous solution: Kinetics, isotherm, thermodynamics and parametric optimization. Sanjay Sarkar, Nitika Tiwari, Meerambika

Behera, Sankha Chakrabortty, Kavya Jhingran, **Kali Sanjay**, Shirsendu Banerjee, Suraj K. Tripathy, *Journal of the Indian Chemical Society*, Volume 99, Issue 5, 100447,2002.

18. Reclamation of tungsten from spent HDS catalyst: a detailed study, Mahalik, Surjeet, A. R. Sheik, Barsha Dash, C. K. Sarangi, and **K. Sanjay**, *Indian Chemical Engineer* 1-14, 2022.
19. Ionic mass transfer at point electrodes located at cathode support plate in an electrorefining cell in presence of rectangular turbulent promoters, Subbaiah, T., P. Vijetha, B. Marandi, **K. Sanjay**, and M. Minakshi., *Sustainability* 14, no. 2 , 880, 2022.
20. Recovery of Lead as Lead Sulphide from Anode Slime Using Hydrometallurgical Technique, Mishra, G., B. Dash, A. R. Sheik, C. K. Sarangi, P. Vijetha, **K. Sanjay**, M.K. Ghosh, and T. Subbaiah., *Journal of The Institution of Engineers (India): Series D* 102, no. 2 489-494, 2021.
21. Citric acid mediated leaching kinetics study and comprehensive investigation on extraction of vanadium (V) from the spent catalyst, Mohanty, C., S. S. Behera, B. Marandi, S. K. Tripathy, P. K. Parhi, and **K. Sanjay**, *Separation and Purification Technology* 276, 119377, 2021.
22. Sorptive removal of malachite green from aqueous solution by magnetite/coir pith supported sodium alginate beads: Kinetics, isotherms, thermodynamics and parametric optimization, Sanjay Sarkar, Nitika Tiwari, Aradhana Basu, Meerambika Behera, Bhaskar Das, Sankha Chakrabortty, **Kali Sanjay**, Mrutyunjay Suar, Tapan Kumar Adhya, Shirsendu Banerjee, Suraj K Tripathy, *Environmental Technology & Innovation*, Volume 24, 101818, 2021
23. Manganese enrichment of polymetallic oceanic nodules via selective leaching process for energy storage applications, Priyanka Mukherjee, Sushree Pattnaik, **Kali Sanjay**, Mamata Mohapatra, *Journal of Chemical Technology & Biotechnology*, Vol 96(5), 1246-1257, 2021
24. Synthesis of iron molybdate from molybdenum spent catalyst and evaluation of its electrochemical properties, Rasmita Barik, Priyanka Mukherjee, Kishor Kumar Sahu, **Kali Sanjay**, Malay Kumar Ghosh, Mamata Mohapatra, *Environmental Progress & Sustainable Energy*, Vol 40 (3), 13560, 2021.
25. An anionic and cationic surfactant-assisted hydrothermal synthesis of cobalt oxide nanoparticles as the active electrode material for supercapacitors, RR Samal, Aneeya K Samantara, S Mahalik, JN Behera, B Dash, **K Sanjay**, *New Journal of Chemistry*, Vol 45 (5), 2795-2803, 2021.
26. Solvent Extraction of Copper Enhanced by Mixing Cavities in Micromixer, Abdul Rauf Sheik, Amol A Kulkarni, **Kali Sanjay**, *Solvent Extraction Research and Development, Japan*, Vol 28 (1), 37-47, 2021.
27. Unravelling for 1st time electrochemical sensing of As (III) by 3D cavitized kagome type lattice, Priyanka Mukherjee, Benjamin Raj, Arun Kumar Padhy, **Kali Sanjay**, Suddhasatwa Basu, Mamata Mohapatra, *Journal of Electroanalytical Chemistry*, Volume 877, 114725, 15 November 2020.
28. Leaching of Rare Earth Elements from the Residue Generated by the Lixiviation of Waste Phosphor with Sulphuric Acid, A Anand, R Singh, J Samantray, MK Ghosh, **K Sanjay**, *Transactions of the Indian Institute of Metals*,1-11, 2020.
29. A pyro-hydrometallurgical process for the recovery of alumina from waste aluminium dross, A K Tripathy, S Mahalik, C K Sarangi, B C Tripathy, **K Sanjay**, IN Bhattacharya, *Minerals Engineering*, Vol 137, 181-186, 2019.
30. Sodium fluoride assisted acid leaching of coal fly ash for the extraction of alumina, AK Tripathy, B Behera, V Aishvarya, A R Sheik, B Dash, C K Sarangi, B C Tripathy, **K Sanjay**, I N Bhattacharya, *Minerals Engineering*, Vol 131, 140-145, 2019.

31. Raman analysis of the formation of dithionate during copper electrowinning, Tondepu Subbaiah, Chinmaya Kumar Sarangi, **Kali Sanjay**, Manickam Minakshi Sundaram, *World of Metallurgy – ERZMETALL*, Vol. 71, Issue. 2, 92-98, 2019.
32. Leaching and Preparation of Co-Mo Sulfide/Oxide Nanoparticles from Spent Catalyst, Mamata Mohapatra, Suchismita Sahu, Rasmita Barik, Eliza Padhan, Priyanka Mukherjee, Mahasweta Moharana, Alfara A. Baba, **Kali Sanjay**, *JOM*, Vol. 70, No. 10, 1-7, 2018.
33. Factorial design for process optimization and generation of kinetic data for yttrium and europium leaching, Amit Anand, Randhir Singh, Malay Kumar Ghosh, **Kali Sanjay**, *Mineral Processing and Extractive Metallurgy*, 1-9, 2018.
34. Recovery of dimethylglyoxime (DMG) from Ni-DMG complexes, Meenakshi Rath, Laxmi Priya Behera, Barsha Dash, Abdul Rauf Sheik, **Kali Sanjay**, *Hydrometallurgy*, Vol 176, 229–234, 2018.
35. Influence of synthesis temperature on the growth and surface morphology of Co_3O_4 Nanocubes for supercapacitor applications, Rashmirekha Samal, Barsha Dash, Chinmaya Kumar Sarangi, **Kali Sanjay**, Tondepu Subbaiah, Gamini Senanayake, Manickam Minakshi, *Nanomaterials*, Vol 7(11), 356, 2017.
36. Electrochemical fencing of Cr (VI) from industrial wastes to mitigate ground water contamination, N Shukla, MK Harbola, **K Sanjay**, R Shekhar, *Transactions of the Indian Institute of Metals*, Vol 70 (2), 511-518, 2017.
37. Branched Platinum Nanostructures on Reduced Graphene: An excellent Transducer for Nonenzymatic Sensing of Hydrogen Peroxide and Biosensing of Xanthine, Tapan Kumar Behera, Subash Chandra Sahu, Biswarup Satpati, Bamaprasad Bag, **Kali Sanjay**, Bikash Kumar Jena, *Electrochimica Acta*, Vol 206, 238–245, 2016.
38. Processing Nigerian pyrolusite ore, Part I: Characterization and dissolution kinetics analysis, A. A. Baba, L. Ibrahim, R. B. Bale, A. G. F. Alabi, F. A. Adekola, M. K. Ghosh, **K. Sanjay**, and A. R. Sheik, *Canadian Institute of Mining, Metallurgy and Petroleum Journal*, Vol 7(1), 43-51, 2016.
39. Micellar mediated selective leaching of manganese nodule in high temperature sulfuric acid medium, R. Barik, **K. Sanjay**, B.K. Mishra, M. Mohapatra, *Hydrometallurgy*, Vol 165(1), 44–50, 2016.
40. Reactor and column leaching studies for extraction of copper from two low grade resources: A comparative study, Sandeep Panda, Geetanjali Mishra, Chinmaya Kumar Sarangi, **Kali Sanjay**, Tondepu Subbaiah, Subir Kumar Das, Kadambini Sarangi, Malay Kumar Ghosh, Nilotpala Pradhan, Barada Kanta Mishra, *Hydrometallurgy*, Vol 165(1), 111–117, 2016.
41. Electrolytic manganese dioxide (EMD): a perspective on worldwide production, reserves and its role in electrochemistry, Avijit Biswal, Bankim Chandra Tripathy, **Kali Sanjay**, Tondepu Subbaiah and Manickam Minakshi, *RSC Adv*., 5, 58255–58283, 2015.
42. Aluminium recovery from NALCO fly ash by acid digestion in the presence of fluoride ion, A.K. Tripathy,C.K. Sarangi, B.C. Tripathy, **K. Sanjay**, I.N. Bhattacharya, B.K. Mahapatra, P.K. Behera, B.K. Satpathy, *International Journal of Mineral Processing*, Vol 138, 44–48, 10 May 2015.
43. Recovery of Co metal and Electrolytic Manganese Dioxide (EMD) from Co–Mn sludge, A. Biswal, S. Mahakud, Sandhyarani Bhuyan, B. Dash, C.K. Sarangi, **Kali Sanjay**, B.C. Tripathy, T. Subbaiah, I.N. Bhattacharya, Sung-Ho Joo, Shun Myung Shin, K.H. Park, *Hydrometallurgy*, Vol 152, 159–168, 2015.
44. Ligand mediated eco-friendly leaching of zinc from spent catalyst in alkaline media, M. Mohapatra, Banaja Nayak, **K. Sanjay**, T. Subbaiah, B.K. Mishra, *Journal of Industrial and Engineering Chemistry*, Vol 20, Issue 4, 2217–2223, 2014.
45. Electro-crystallization of Antimony from Acidic and Alkaline Baths in Diaphragm-less

Cell, Chinmaya Kumar Sarangi, Ayonbala Baral, Jayasmita Panigrahi, **Kali Sanjay**, Tondepu Subbaiah, Barada Kanta Mishra, *Advanced Materials Research,* Vol. 828, 65-72, 2014.

46. Behaviour of arsenic(III) and antimony(III) during electrowinning of nickel from aqueous sulphate solutions; R.R. Samal, C.K. Sarangi, B.C. Tripathy**, K. Sanjay**, I.N. Bhattacharya, T. Subbaiah., *Hydrometallurgy*, Vol. 139, 39-45, 2013.
47. Aqueous processing of nickel spent catalyst for a value added product; Sheik, A.R., Ghosh, M.K**., Sanjay, K.**, Subbaiah, T., Mishra, B.K., Baba, A.A.; *Korean Journal of Chemical Engineering,* Vol. 30 (2), 400-404, 2013.
48. Extraction of Cu and Cr from a spent Cu–Cr catalyst: Recovery enhancement through mechanical activation; Swaroopa, S., Ghosh, M. K., **Sanjay, K.** and Mishra, B. K. *Hydrometallurgy*, Vol. 136, 8–14, 2013.
49. Extraction of Ni (II) from Spent Hydrodesulfurization HDS Catalyst Through Leaching and Electroless Precipitation of Ni(OH)2., Pradhan, S.R., Dash, B., **Sanjay, K.,** Subbaiah, T. *Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science*, Vol. 44(2), 469-476, 2013.
50. Dissolution kinetics of nickel from spent catalyst in nitric acid medium. Sheik, A.R., Ghosh, M.K., **Sanjay, K**., Subbaiah, T., Mishra, B.K. *Journal of the Taiwan Institute of Chemical Engineers*, Vol. 44, Issue 1, 34-39, 2013.
51. Influence of the microstructure and its stability on the electrochemical properties of EMD produced from a range of precursors, A Biswal, BC Tripathy, **K Sanjay**, D Meyrick, T Subbaiah, M Minakshi, *Journal of Solid State Electrochemistry* 17 (12), 3191-3198, 2013.
52. Influence of alternative alkali reagents on Fe removal during recovery of Mn as Electrolytic Manganese Dioxide (EMD) from Mn sludge, Avijit Biswal, Barsha Dash, BC Tripathy, T Subbaiah, Shun Myung Shin, **Kali Sanjay**, BK Mishra, *Hydrometallurgy* 140, 151-162, 2013.
53. Insights into heap bioleaching of low grade chalcopyrite ores — A pilot scale study., S. Panda**, K. Sanjay**, L.B. Sukla, N. Pradhan, T. Subbaiah, B.K. Mishra, M.S.R. Prasad, S.K. Ray., *Hydrometallurgy.*, Vol. 125-126., 157-165, 2012.
54. Electrokinetic cleaning of industrial residues; **Sanjay, K.,** Shekhar, R.; *Transactions of the Institutions of Mining and Metallurgy, Section C: Mineral Processing and Extractive Metallurgy*, Vol 121 (2), 117-120, 2012.
55. Electroosmotic pump: Rate controlling mechanism for unusually fast electroremediation kinetics of Cr(VI) in basic Kanpur soil; **Sanjay Kali**, R.P. Das, Rajiv Shekhar; *Electrochimica Acta*, Vol 86, 80-88, 2012.

Research Projects

Projects successfully completed as Project Leader

1. 'Detailed Engineering Design of Solvent Extraction – Electrowinning for extraction of cobalt from super alloy scraps: 200 kg/day capacity'. M/s Rubamin Ltd., Baroda.
2. 'Modelling of the electrorefining cell in the pyroprocessing demonstration facility', IGCAR (DAE), Kalpakkam.
3. 'Development of electrochemical mixer-settler and optimization studies for the recovery of palladium from high-level liquid waste', IGCAR (DAE), Kalpakkam.
4. 'Extraction of Tungsten values from Hutti gold mine tailings concentrate and scrap: process flow sheet development, bench scale studies and pilot scale testing'; Defense Metallurgical Research Laboratory (DRDO), Hyderabad.
5. 'Recovery of alumina from Fly ash – modifications and validation of flow sheet'; National Aluminium Company Ltd. (NALCO), Bhubaneswar.
6. 'Recovery of Electrolytic Manganese Dioxide (EMD) from Manganese Ore: Process

optimization for existing plant at MOIL, alternate process development and Basic Engineering Package preparation'; Manganese Ore India Ltd. (MOIL), Nagpur.

7. 'Technology transfer of cobalt manufacture'; Mishra Dhatu Nigam Limited, (MIDHANI), Hyderabad.
8. 'Evaluation of suitability of Nano iron/ iron oxide powders for energy and sensor applications'; National Minerals Development Corporation (NMDC), Hyderabad.
9. 'Cobalt technology from impure cobalt hydroxide: Process flow sheet development'; Mishra Dhatu Nigam Limited (MIDHANI), Hyderabad.
10. 'Technology development, demonstration and shifting of 1000 cm^2 EM cell for splitting of sodium sulphate solution to sodium hydroxide and sulphuric acid'; Heavy Water Board, Mumbai.
11. 'Electroremediation of soils contaminated with heavy metals / organic pollutants and radio nuclides', CSIR Taskforce.
12. 'Waste to wealth through Hydro & Electrometallurgical processing', CSIR Non-network project.
13. 'Engineering consultancy work for development of Electrolytic – Membrane process for conversion of effluent sodium sulphate solution to sodium hydroxide and sulphuric acid'; HWB (DAE), Mumbai.
14. 'Multifunctional electrodes and electrolytes for futuristic electrochemical technologies'; CSIR XII plan (CSC0101), New Delhi.
15. 'Feasibility studies to recover Mn metal from low grade Mn ore'; TATA Steel Ltd., Jamshedpur.
16. 'Process scale-up and feasibility study for improving Mn/Fe ratio of low grade manganese ore'; TATA Steel Ltd., Jamshedpur.
17. 'Evaluation of design parameters for dewatering of manganese nodules'; National Institute of Ocean Technology (NIOT), Chennai.
18. 'Recovery of alumina from Fly ash'; CSIR (FTT Project).
19. 'Technology Development for holistic utilization of Red Mud'; HINDALCO, NALCO and VEDANTA.
20. 'Process development and bench scale testing for recovery of Lithium and Cobalt from spent Lithium batteries'; Excel Industries Ltd. Mumbai.
21. 'Recovery of copper from copper oxide ore'; Onshore Construction Company Pvt. Ltd., Mumbai
22. 'Feasibility Studies for Preparation of Fused Magnesia from Kimberlite Tailings' **(Project Leader)**; NMDC Hyderabad.

Ongoing projects

1. 'Technology development (Extractive metallurgy) for Polymetallic nodules (PMN)' (**Project Leader**); Ministry of Earth Sciences, Govt. of India.
2. 'Titanium dioxide recovery and waste management from vanadiferrous titano-magnetite and ilmenite concentrates' **(Project Leader)**; Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australia.
3. 'Advanced recovery of the battery materials and REE from ores and wastes' (AISRF Round 14) (**Project Leader**); Indo-Australian Project, Department of Science & Technology, Govt. of India.
4. 'Upscaling of Nd metal/Nd-Pr production along with other rare earth metals (La,Ce) and

their alloys by Molten Salt Electrolysis routes' (**Project Leader – CSIR IMMT**); CSIR, New Delhi

5. 'Scale-up study of electrolysis of Cuprous chloride (Phase I)' (**Project Leader**); ONGC Energy Center, Mumbai.
6. 'Setting up of pilot cum demonstration plant for recovery of alumina and value-added products from fly ash' (**Project Leader**); Ministry of Mines, NALCO & CSIR.
7. 'Process design for Se, Te, Cu Recovery' **(Co-Project Leader)**; Sterlite copper, Silvassa plant, A unit of Vedanta Ltd, Silvassa.
8. 'Kinetic studies of different unit operations (desilication, digestion, and precipitation) of Bayer process at NALCO'; **(Member)**; NALCO Bhubaneswar.
9. 'Plant Audit of MALCO Energy Limited-Nickel Business Unit' **(Co-Project Leader)**; MALCO Energy Limited (MEL), A unit of Vedanta Ltd, Silvassa.
10. 'Production of Ferro-Titanium alloy from Bauxite residue by recovery and matrix change of the metal values'; **(Co-Project Leader)**; NALCO Bhubaneswar.
11. 'Shipboard-based nodule sieving and dewatering studies and prototype design development'; **(Co-Project Leader)**; NIOT Chennai.
12. 'Study on breakage/ degradation of Polymetallic Nodules during vertical slurry transport through a pipe'; **(Co-Project Leader)**; NIOT Chennai.
13. 'Recovery of Dehydrated Magnesium Chloride Using Sea Water Bitterns at Relatively low Temperatures in Pilot Scale'; **(Co-Project Leader)**; CSIR.
14. 'Solvent Extraction (SX) Pilot Plant for REE Separation' **(Co-Project Leader)**; CSIR.
15. 'An advanced technology for improvement in alumina productivity: Scale-up testing and process validation'; **(Member)**, Vedanta Ltd.
16. 'Hematite production and recovery of valuable metals from Jarosite' **(Co-Project Leader)**; Hindustan Zinc Ltd. Udaipur
17. 'Recovery of Selenium and Tellurium from anode slimes **(Co-Project Leader)**; Sterlite copper, Silvassa plant, A unit of Vedanta Ltd, Ministry of Mines, CSIR.
18. 'Recovery of Copper from low-grade copper ores: oxide and sulfide ores' **(Co-Project Leader)**; CSIR.
19. 'Recovery of Co and Ni from Chromite Overburden and residue utilization' **(Co-Project Leader)**; CSIR.
20. 'Recovery of vanadium from pet coke ash, spent vanadium catalyst and vanadium concentrate' **(Co-Project Leader)**; CSIR.

Projects completed as Co-Principal Investigator (Co-PI) / Activity in-charge / Member

Sr.	Title of the project	Funding agency
1	Nickel Technology Proving Plant at RRL by GTZ-CSIR-HZL (10 tpd raw material processing 'Technology Proving Plant')	German Agency for Technical Collaboration (GTZ), CSIR & HZL
2	Development of process for extraction of Cu, Ni, Co & Mn from deep sea ocean nodules and testing in pilot scale (Technology Proving Plant in a scale of 500 kg/day nodules)	Ministry of Earth Sciences, New Delhi
3	Advice on processing of secondary cobalt containing materials	M/s Rubamin Ltd, Baroda
4	Literature survey on electrolytic nickel hydroxide	M/s Techno Chemicals, Mumbai
5	Preparation of engineering package for a 1200 tpa nickel electrowinning plant	M/s NICOMET Ind. Ltd., Mumbai
6	Pressure leaching of Ni-Co sulphides of M/s Nicomet Industries Ltd	M/s NICOMET Ind. Ltd. , Mumbai
7	Development of a process for recovery of metal values from dust and sludges of Durgapur Steel Plant	RDCIS, Ranchi
8	Preparation of Nickel Hydroxide suitable to Nickel Cadmium and Nickel metal hydride batteries	MNES, New Delhi
9	Solid and liquid waste inventorisation, characterization and disposal plan for the proposed second phase expansion for NALCO production and handling plants. (Smelter at ANGUL)	National Aluminium Company Ltd. (NALCO), Bhubaneswar
10	Basic study on precipitation of Boehmite	National Aluminium Company Ltd. (NALCO), Bhubaneswar
11	Technical know-how and experimental back up for electrolytic reduction of iron (III) present in phosphoric acid to iron (II) state	Heavy Water Board (DAE)
12	Prevention of coal dust at mechanical coal handling plant	Paradip Port Trust, Odisha
13	Recovery of copper and tellurium from secondary raw materials	M/s Grishma Special Chemicals, Mumbai
14	Development and design of diaphragm-less cells for electrolytic acid killing	IGCAR (DAE), Kalpakkam
15	Recovery of copper from copper bearing slag tailings	Aditya Birla Copper, Mumbai
16	Chromite recovery from COB plant tailings and sub grade chromite ore	Jindal Stainless Steel, Bhubaneswar
17	Consultancy assistance for setting up of the 500TPD commercial chromite beneficiation plant and to assist its flotation plant performance evaluation	Jindal Stainless Steel, Bhubaneswar
18	Laboratory scale study on alumina trihydrate productivity using catalyst	National Aluminium Company Ltd. (NALCO), Bhubaneswar

19	Collection characterization and screening of potential micro algae from West Bengal and Odisha coast and pilot scale demonstration of algal oil production	Department of Biotechnology, New Delhi
20	Microbial desulphurization of calcined petroleum coke (Phase I & II)	ALCOA, USA
21	Laboratory testing of copper oxide ore, Oman	Engineers India Ltd., New Delhi
22	Production of manganese sulphate from low grade manganese ore of Gujarat by non-conventional leaching techniques	Gujarat Mineral Development Corporation, Gujarat
23	Globally competitive chemical processes and products	CSIR taskforce project
24	Consultancy for installation and commissioning of a commercial plant to produce 8 tpd of high pure Cu cathode through acid leaching – electrowinning route	M/s ASSM General Trading Company, UAE
25	Recovery of nickel from chromite over burden of Orissa Mining Corporation	Orissa Mining Corporation, Bhubaneswar
26	Detailed Design, Inspection, Testing and Commissioning of Electrolytic Reduction Cell Assembly for TDP at RCF, Trombay	Heavy Water Board (DAE), Mumbai
27	Nickel recovery from refinery electrolyte (Phase-I&II)	Hindalco Industries (Birla copper unit), Dahej
28	Recovery of tellurium powder from anode slime	Hindalco Industries (Birla copper unit), Dahej
29	Recovery of lead from anode slime	Hindalco Industries (Birla copper unit), Dahej
30	Basic engineering process package for recovery of tellurium powder and removal of lead from anode slime	Hindalco Industries (Birla copper unit), Dahej
31	Metallurgical test work on recovery of Cu from leach residue	M/s. Chandra Proteco Ltd., Silvassa, India
32	Preparation of techno-economic feasibility report for 700 tpd low grade rock phosphate ore beneficiation plant for RSMML, Rajasthan	Rajasthan State Mines & Minerals Ltd., Udaipur, Rajasthan
33	Recovery of copper from copper bearing slag tailings	Aditya Birla Copper, Mumbai
34	Preparation and characterization of EMD suitable for batteries from slurry containing Mn and Co	KIGAM, South Korea
35	Recycling of Lithium ion batteries	Renault Nissan Technology, Chennai
36	An investigation on recovery of alumina in NALCO fly ash through pyro-hydrometallurgical / bioprocessing methods	National Aluminium Company Ltd. (NALCO), Bhubaneswar (NALCO),
37	Electrochemical process for improving productivity of alumina in Bayer liquor	National Aluminium Company Ltd. Bhubaneswar

38	Recyclability strategy of value added utilization of iron/ manganese ore tailing /low grade ore: evaluation of energy storage capacities	Ministry of Mines, Govt. of India
39	Processing of secondary resources for the production of battery materials	CSIR-FTT Project
40	Manganese nodules slurry characteristics and pumping studies for vertical transport	NIOT, Chennai
41	Multi-helical microfluidic system for integrated extraction- separation of metal ions	Department of Science and Technology (DST), Govt. of India
42	Feasibility of bauxite leaching under high temperature conditions	HINDALCO Industries Limited, Belagavi
43	Preparation of Basic Engineering Package (BEP) for setting up of pilot plant on use of fly ash/pond ash for production of wear resistant ceramic tiles	National Aluminium Company Ltd. (NALCO), Bhubaneswar
44	Optimization of process for the treatment of Spent Pot Lining carbon for the recovery of valuables and bench scale testing	National Aluminium Company Ltd. (NALCO), Bhubaneswar
45	Development of process for production of pure and white Alumina Tri Hydrate (ATH) for solid surface application	National Aluminium Company Ltd. (NALCO), Bhubaneswar
46	Sedimentation studies, up-scale testing and basic engineering for thickener for treatment of Mn ore fines	Manganese Ore India Limited (MOIL), Nagpur
47	Feasibility Laboratory Studies for Liberator Cake Quality Improvement and Copper Electrowinning Process Optimization in Cu refinery at Dahej	HINDALCO Birla Copper Unit, Dahej
48	Electrolytic-membrane process for the production of hydrogen from seawater (Phase I: Laboratory scale optimization)	ONGC Energy Center, Mumbai.

Technology / Process / Know-how developed

S. No.	Title	Year of development	Organization /Industry
1	Recovery of copper from copper oxide ore from DR Congo and providing Basic Engineering Process Package for 12000 TPA Cu extraction plant and associated cobalt.	2025	Onshore Construction Company Pvt. Ltd., Mumbai
2	Process development and bench scale testing for recovery of Lithium and Cobalt from spent Lithium batteries	2025	Excel Industries Ltd. Mumbai
3	Recovery of Co and Ni values from scrap	2025	MIDHANI, Hyderabad
4	Recovery of Co from impure Co hydroxide cake	2025	MIDHANI, Hyderabad
5	Recovery of Electrolytic Manganese Dioxide (EMD) from Manganese Ore: Process optimization for existing plant at MOIL, alternate process development and Basic Engineering Package preparation	2022	MOIL, Nagpur
6	Recovery of tungsten from scrap and Hutti gold mine tailings	2020	DMRL (DRDO), Hyderabad
7	Recovery of alumina, silica and iron values from Indian fly ash	2019	National Aluminium Company (NALCO), Bhubaneswar
8	Splitting of sodium sulphate bearing effluent through electro-membrane process for the production of sodium hydroxide and sulphuric acid	2017	M/s Heavy Water Board, Mumbai
9	Recovery of Pd from spent nuclear fuel effluent (High level liquid waste) using ionic liquids	2015	Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam
10	Recovery of high pure Te, Cu and Pb from anode slime	2012	M/s Hindalco Industries Ltd., Dahej, Gujarat.
11	Electrochemical reduction cell assembly design.	2008	M/s Heavy Water Board, Mumbai
12	Chromite recovery from COB plant tailings and sub-grade chromite ore.	2008	M/s Jindal Stainless Steel Limited, Bhubaneswar
13	Recovery of Ni and Co from Chromite Overburden (COB) through reduction roasting-ammoniacal leaching route	2003	CSIR, Hindustan Zinc Ltd., GTZ-Germany
14	Recovery of Cu, Ni and Co from polymetallic nodules through ammonia- ammonium sulphate-sulphur dioxide leaching route	2000	Ministry of Earth Sciences, New Delhi
15	Recovery of cobalt carbonate from cobalt bearing slag of South Africa	1998	M/s Shalina Trading Corporation Ltd., Mumbai
16	Recovery of cobalt from super alloy scrap/sludge.	1997	M/s Rubamin Ltd., Baroda
17	Production of Copper cathode from secondary sources	1997	M/s Hydromet India Ltd, Kancheepuram