Dr. ABHILASH ***M.Sc., Ph.D., FSABT, MNASc***

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** Principal Scientist, Secondaries and Resource Utilisation Group,**

 **Metal Extraction & Recycling Division,**

 **CSIR-National Metallurgical Laboratory, Jamshedpur, INDIA**

 ***Assistant Professor, ACSIR-NML, Jamshedpur***

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****[**www.nmlindia.org/biometallurgy**](http://www.nmlindia.org/biometallurgy)**,** [**www.abhibios.org**](http://www.abhibios.org)



**PERSONAL DETAILS**

* **Date of Birth:** 14th Jan 1981
* **Place of Birth:** Jaduguda, Jharkhand (Formerly State of Bihar), India
* **Nationality:** Indian
* **Mother’s Name:** Smt. Sudha Pillai
* **Father’s Name:** Shri. M.R.Shivan Pillai
* **Permanent Address:** “Aswathy”, P.O. Muttom, Via Haripad, Dist: Alleppey, Kerala-690511
* **Current Residence Address:** A-4-44, NML Flats, P.O.Agrico, Jamshedpur, Jharkhand-831007

**OBJECTIVE**

Challenging research scientist position specialized with microbial mineral biotechnology and hydrometallurgy in environmental technology & waste recycling with a high-growth engineering research organization engaged in interdisciplinary process and technological solutions in minerals, metals, materials and environment, with keen interest for expertise build-up and practice long-term research initiatives/collaborations

**PROFESSIONAL OVERVIEW**

* Experience in teaching environmental microbiology, biohydrometallurgy, biochemical engineering, waste recycling and engaging wet labs
* Experience in sophisticated research techniques and technologies: biohydrometallurgy, microbial isolation and characterization, reactor design/operation, bioremediation and waste recycling, REE extraction, WEEE Recycling, process testing and validation
* Organized, take-charge professional with exceptional follow through abilities and detail orientation; able to plan and forth-seeing projects from concept to successful conclusion
* Demonstrated ability to efficiently prioritize a broad range of responsibilities in order to achieve maximum level of operating effectiveness
* Expertise in lab and field research, data collection/analysis and project management, ability to align with cross-functional scientific and research teams

**EDUCATIONAL QUALIFICATIONS**

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| * Ph.D. (Biochem. Engg)- Biohydrometallurgy of Uranium ores, **Jadavpur University**, INDIA (2012)
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| * M.Sc. Biotechnology (Mineral Biotechnology), **Bangalore University**, INDIA (2003), 75.50%
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| * B.Sc. Microbiology (with Chemistry), **Nagpur University,** INDIA (2001), 75.33%
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**PROFESSIONAL EXPERIENCE (Chronological)**

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| * Currently Employed as **Principal Scientist,** CSIR-National Metallurgical Laboratory, Jamshedpur (since 2016): *Merit Promotion*
* Worked as **CSIR-Raman Research Fellow (Guest Scientist)** at BGR, Hannover, Germany (March to June 2019): *Guide- Prof. Axel Schippers*
* **Senior Scientist,** CSIR-National Metallurgical Laboratory, Jamshedpur (since 2013): *Merit Promotion*
* Worked as **Scientist,** CSIR-National Metallurgical Laboratory, Jamshedpur (2010-2013)
* Serving as **Assistant Professor**, ACSIR-NML, Jamshedpur (since 2013)
* Inducted as **Corporate Faculty** at MRD Life Sciences,Lucknow, India (since 2010)
* **Junior Scientist,** CSIR-National Metallurgical Laboratory, Jamshedpur (2007-2010)
* **Project Assistant,** CSIR-National Metallurgical Laboratory, Jamshedpur (2005-2007)
* **Lecturer,** SRN ADARSH College, Bangalore University (2004-2005)
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**TEACHING RECORD**

*Subjects Taught with course material preparation (Masters, PhD level)*

* Biohydrometallurgy
* Microbiological methods
* Waste Remediation and Pollution control
* Environmental Chemistry and Biogeochemistry
* Water and Environmental Management
* Waste Recycling and Utilization, and Remediation
* Solid, Liquid and Gaseous Hazardous Waste Management
* Extractive Metallurgy of strategic and critical metals
* New materials synthesis

*Wet Lab classes with course material preparation (Masters, PhD level)*

* Biomineral Processing
* Water Chemistry
* Biotechnology in Environmental Engineering
* Environmental Technology in Waste Recycling and Utilization
* Nanotechnology for biomaterial synthesis
* Chemical Engineering and Hydrometallurgy

**COMPETENCY AND RESEARCH INTERESTS**

RESEARCH

* ***Biohydrometallurgy:*** Bioleaching of uranium from low grade indian ores, copper from low grade Indian ores and converter slag, zinc from tailings/ complex/lean ores, metals from ocean deposits, metals from industrial wastes; Biosorption/Bioremediation of heavy metals from effluents, sludges, mine overburdens, acid mine drainage; Bio-beneficiation of chromite, iron ores and slimes, refractory bauxite ores, manganese ores, coal, etc.; Material Biosynthesis of inorganic nanomaterials from wastes; Microbial corossion evaluation
* ***Recycling and Waste Utilisation:*** Rare Earth Element Extraction; Battery Recycling; WEEE Recycling; Allied Aspects of Waste to Wealth and Energy

**EXTRACURRICULAR SKILLS**

**Computer Skills*:*** Web authoring and designing, Operating systems, Business softwares, FACTSAGE, ORIGIN, HSC Chemistry

**Bioinformatics tools:** NCBI, BLAST, MEGA-6

**RESEARCH GRANTS PURSUED**

1. Team Member for “Biomineral Processing for extraction of metal values from ores/concentrates/wastes", Funded by CSIR, New Delhi (2002-2007) (Value: 170,968USD)
2. Team Member for “Treatment/bioremediation of electroplating and leather tanning effluents containing chromium", Funded by CSIR, New Delhi (2002-2007) (Value: 104,133 USD)
3. Principal Investigator for “Microbial leaching of Narwapahar uranium ore :In House Project” (2009-10) (Value: 7,772 USD)
4. Co-Principal Investigator for “Bioleaching of Metals from Sea Nodules in Columns and Air Lift Reactors :In House Project” (2009-10) (Value: 7,772 USD)
5. Activity Leader for “Bioleaching of zinc ores/tailings for synthesis of nanosized Zn-based materials” under Biomaterials Module of Nano-Structured Advanced Materials, Funded by CSIR, New Delhi (2007-12) (Value: 59,062,797USD)
6. Team Member for “Providing safe drinking water in rural areas using Solar Disinfection technique”, Funded by DST (2007-09) (Value: 57,507 USD)
7. Team Member for “Development of cost effective mine water reclamation technology for providing safe drinking water”, Funded by DST (2007-09) (Value: 97,917 USD)
8. Team Member in “Characterisation of Samples”, Funded by OMML (2009-10) (Value: 4,662 USD)
9. Principal Investigator in “Characterisation of Copper Slag Samples”, Funded by BIRLA COPPER” (2010-11) (Value: 4,662 USD)
10. Co-Principal Investigator in “Evaluating Corrosion of Zn-Ni Coated Steel”, Funded by TATA STEEL” (2010-12) (Value: 96,353 USD)
11. Principal Investigator in “Biochemical beneficiation of iron ore slimes”, Funded by TATA STEEL” (2011-12) (Value: 13,956 USD)
12. Principal Investigator in “Biosynthesis of iron oxide based magnetic nanoparticles from industrial wastes”, Funded by DST-ILTP under Indo-Russian Collaboration (2010-13) (Value: 42,738 USD)
13. Activity Leader in “Biodesulfurisation of High Sulfur Indian Coals”, Funded by Ministry of Steel (2011-14) (Value: 133,650 USD)
14. Principal Investigator in “Processing of spent Lithium Ion battery”, Funded by Renault Nissan R&D, India (2012-13) (Value: 51,284 USD)
15. Principal Investigator in “Chemical and bioremediation of chromite mine effluents”, Funded by TATA STEEL (2014) (Value: 6,620 USD)
16. Team Member in “Development of newer technologies for rare earth extraction from secondary resources”, Funded by CSIR, New Delhi (2012-2017) (Value: 180,250 USD)
17. Principal Investigator in “Hydrometallurgical replenishment of red mud for extraction of rare earth elements”, Funded by NALCO (2015-16) (Value: 13,644 USD)
18. Principal Investigator in “Scale-up trials in Biobeneficiation of Joda Iron ore slimes”, Funded by TATA STEEL (2015-16) (Value: 26,231 USD)
19. Principal Investigator in “Biochemical dephosphorisation of LD slag”, Funded by TATA STEEL (2015-16) (Value: 10,489 USD)
20. Principal Investigator in “Extraction of REE”s from blast furnace slag”, Funded by TATA STEEL (2015-16) (Value: 15,352 USD)
21. Co-Principal Investigator in “Enhancement in process Efficiency in the Production of Ferro-chromium”, Funded by BALASORE ALLOYS LTD. (2016-17) (Value: 10,411 USD)
22. Co-Principal Investigator in “Dephosphorisation of Calcium Ferrite”, Funded by TATA STEEL (2016-17) (Value: 9,324 USD)
23. Member in "Development of Process Flowsheet for Extraction of Tungsten Metal from Hutti Tailings", Funded by DRDO (2016-18) (Value: 264,153 USD)
24. Co-Project leader in "Extraction of vanadium from spent catalysts", Funded by HINDUSTAN ZINC LIMITED, UDAIPUR (2017-18) (Value: 24, 000 USD)
25. Project leader in “Extraction of REEs from GBFS and possible applications of the residue”, Funded by TATA STEEL (2019-20) (Value: 52,000 USD)

***R&D PROCESSES DEVELOPED***

* Isolation, characterization and purification of microbial isolates from various sources (22 Industrially important isolates; 13 deposited at NCCS)
* Developed the process for bioleaching of low grade silica-rich and apatite-rich ore of uranium, and tested industrial scale of realization (lab scale to 2ton column scale)
* Developed the know-how for bioleaching of low grade chalcopyrite ore (high recovery with consortia leaching)
* Developed the know-how for Biosorption/bioremediation of tannery effluents (for trivalent chromium source)
* Designed the air-lift bioreactor for large scale bioleaching of sea nodules (using extremophiles)
* Developed microbial based composite for metal remediation from aqueous wastes (product)
* Developed the know-how for bioleaching of zinc tailings and synthesis of Zn based nanomaterials (30-60nm ZnO powders of >99% purity)
* Developed know-how for microbial upgradation of iron ore slimes (from 43% Fe to 58% Fe)
* Developed process for bio-desulphurization of high sulfur coal (total sulfur reduction from 3.5% to <0.5%)
* Developed process for extraction of REEs from red mud (95% REOs) hydrometallurgically
* Developed process for extraction of REEs from blast furnace slag (93% REOs) hydrometallurgically
* Postulated process for biochemical dephosphorisation of LD slag (reducing from 1.3 to <0.05% P)
* First Flowsheet globally on bio-recycling of spent EV batteries (jointly with Nissan)
* Developed process for *Ammonium Metavanadate (96%)* and *Vanadium Pentaoxide (>99%)* synthesis from vanadium based secondary resources (sludge, catalysts, etc.)

**PUBLICATIONS**

1. Journals : 46
2. Conferences : 33
3. Edited Books : 05
4. Book Chapter : 09

**PATENTS (FILED/SUBMITTED)**

1. Granted : 05
2. Submitted : 06

**INDUSTRIAL & RESEARCH COLLABORATIONS**

* ***Indian:*** UCIL; HCL; HZL; Sterlite Copper; Vedanta Aluminium; Binani Zinc; Himadri Group, Kolkata; Nikshepa Biomining Corporation, Bangalore; OMC; TATA STEEL; NALCO; Renault Nissan R&D India Centre ; MSPL, Hospet; Birla Copper, Dahej
* ***International:*** Arafura World Resources, Perth; CSIRO, Perth; CMRDI, Cairo; ISCEOR & ICCT of Siberian Branch of Russian Academy of Sciences, Krasnoyarsk, Russia; SDU, Turkey; CETEM, Brazil

**AWARDS AND HONOURS**

* Mishra Award for best paper presented- Bioprocessing at IIME’s MPT-2006, Chennai
* Mishra Award for best paper presented- Bioprocessing at IIME’s MPT-2007, Mumbai
* Second Prize, International Microbiology Photograph Competition, Switzerland, Oct, 2009
* Mishra Award for best paper presented in Bioprocessing at IIME’s MPT-2011, Udaipur
* Young Scientist Award-Engineering Sciences (Indian Science Congress, 2012, Kolkata)
* 1st Prize, Oral Presentation, “Raw Materials Category”, IIM’s NMDATM2012,Jamshedpur
* 1st Prize, Oral Presentation, “Nonferrous Category”, IIM’s NMDATM2012,Jamshedpur
* 2nd Prize, Oral Presentation, “Raw Materials Category”, IIM’s NMDATM2012,Jamshedpur
* 1st Prize in Poster Presentation in “Nonferrous Category” at IIM’s NMDATM 2013, Varanasi
* 2nd Prize, International Microbiology Photograph Competition, Switzerland, Oct, 2013
* Young Scientist Award-Environmental Microbiology (Association of Microbiologist,India,2013)
* Young Scientist Award-Nuclear Fuel Processing (Indian Nuclear Society, DAE, 2013)
* Young Scientist Award-Mineral Biotechnology (Biotech Research Society of India, 2014)
* Young Metallurgist Award-Nonferrous Metallurgy (Ministry of Steel & Mines, GOI, 2014)
* Mishra Award for best paper published-Extractive Metallurgy by IIME for 2013-14
* Prof. H.J.Arnikar Best PhD. Thesis, Indian Assoc. Nucl. Chem. Allied Scientists (DAE), 2015
* 1st Prize, Poster Presentation, Nat. Sem. Recent Adv. in Biotechnology, April, 2015, Kolkata
* 2nd Prize: Metallurgical Research & Technology 2015 Best Paper Award (January 2016)
* Outstanding Review Status given by Elsevier's Annals of Nuclear Energy (Nov 2015)
* Article cited on cover page of Indian Journal of Geomarine Sciences (2015)
* TAMOTIA Award-Best Paper Presented in Environmental Management, IIME (2017), Chennai
* Awarded Membership by National Academy of Sciences, India, 2017
* Young Engineer Award, Mineral Engineering Science Association, Vishakapatnam, India (2017)
* Mishra Award for best paper published (2017) in Hydrometallurgy at IIME’s MPT-2019, Hyderabad [Article: Journal of Cleaner Production 157 (2017) 322-332]
* Mishra Award for best paper presented in Hydrometallurgy at IIME’s MPT-2019, Hyderabad

**PUBLIC AND PROFESSIONAL SERVICES**

**FELLOWSHIPS & PROFESSIONAL AFFILIATIONS/MEMBERSHIPS**

* ***Fellow –*** Society for Applied Biotechnology, India
* ***Member*** *(International Scientific Committee)* ***–*** International Biohydrometallurgy Council
* ***Affiliated Member -*** National Academy of Sciences, India; IUPAC
* ***Life Member –*** Indian Institute of Mineral Engineers (IIME), Indian Institute of Metals (IIM); Association of Microbiologists of India (AMI); Indian Nuclear Society (INS); Biotech Research Society of India (BRSI); Indian Association of Nuclear Chemists and Allied Scientists (IANCAS); Materials Research Society of India (MRSI); Indian Science Congress Association (ISCA); Kerala Academy of Sciences (KAS); Administrative Staff College of India (ASCI); Society of Biological Chemists, India (SBC); National Academy of Biological Sciences, India (NABS); Chemical Research Society of India (CRSI)
* ***Subscription Member-*** Society for Applied Microbiology, U.K. (SFAM); Society of Industrial Microbiology, U.S. (SIM); The Minerals, Metals & Materials Society (TMS), US; Asia-Pacific Chemical, Biological& Environmental Engineering Society (APCBEES); European Federation of Biotechnology (EFB-FEMS); American Society of Microbiology (ASM); Indian Society of Education and Environment (ISEE); International Association of Chemical Engineers

**COMMITTEE INVOLVEMENTS (CONF./ACADEMIC)**

* Program Committee Chair, Int. Conf. on Chem. Biol. Environ. Engineering, China, Dec, 2009
* Member, Research Group on Possibilities of Valuation of H2S in Black Sea (FP7-EU)
* Member Expert, TPC-Biomineral Processing, IEEE-World Cong. Eng. Technol., China
* Member, Application of Mat. Chem. Eng.(AMCE), World Academic Publishing, US
* Member, Program Committee, Int. Conf. Metall. Technol. Mat. (ICMTM-2012), Korea
* Member, Technical Committee, Conf. Environ. Poll. Pub. Health (CEPPH 2012), China
* Member, Editorial Board, 15th Int. Conf. on Nonferrous Metals, 2011, Kolkata, India
* Chairman, Editorial Board, 16th Int. Conf. Nonferrous Metals, 2012, New Delhi, India
* Member, Editorial Board, 17th Int. Conf. on Nonferrous Metals, 2013, Ranchi, India
* Chairman, Editorial Board, 18h Int. Conf. Nonferrous Metals, 2014, Nagpur, India
* Co-Chairman, Editorial Board, 19th Int. Conf. on Nonferrous Metals, 2015, Bhubaneswar, India
* Member, Editorial Board, 20th Nat. Conf. on Nonferrous Metals, 2016, Jamshedpur, India
* Adhoc Reviewer- IMPC-2010, Australia; IMPC-2012, India; IBS-2011, China
* PhD Examiner-reviewer for Dept. of Microbiol-Biotechnol, Gujarat Univ., India; BIT, Mesra
* Int. Committee Member, SIPS-2015, Antalya, Turkey
* Member, Emirates Association of Chemical, Biological & Environment Engineers
* Scientific Board member, Institute of Research Engineers and Doctors (IRED)
* Scientific Board Member, Int. Institute of Chemical, Biological & Environ Engineering (IICBEE)
* Member, Science Committee, LBSM College, Jamshedpur (2020 onwards)

**JOURNAL INVOLVEMENTS**

* Editorial Board Member, Mineral Processing and Extractive Metallurgy Review (Taylor Francis)
* Editorial Board Member, Russian Journal of Nonferrous Metals (Springer)
* Founding Editor, International Journal of Nonferrous Metallurgy, U.S. (SCRIP)
* Member, Editorial Board, International Journal of Environmental Protection, US
* Member, Editorial Board, Scientific Journal of Environmental Sciences, US
* Associate Editor, International Journal of Advanced Research, India
* Member, Advisory Board, World Research Journal of Environment and Waste Manage., US
* Member, Editorial Board, CIBTECH Journal of Microbiology and Biotechnology
* Member, Editorial Board, Materials Science: Material Review
* Reviewer to International SCI and Non-SCI Journals (Elsevier, Springer, SAGE, ACS, RSC, Wiley, OMICS, etc)

**CONFERENCES/SYMPOSIA/SEMINAR/WORKSHOPS ORGANISED**

* Member, Organising Committee (Training Programme on Extraction of Non-Ferrous Metals and their Recycling (NFTP-2008), NML, Jamshedpur, Feb, 2008; Training Programme for UCIL’s Management Trainees on Mineral Processing and Extractive Metallurgy (MPEM-2008),NML, Jamshedpur, July, 2008; INCOME 2008, NML, Jamshedpur, Dec 2008; MPT-2010, NML, Jamshedpur, Dec 2010; CSIR’s SSBMT Indoor Sports Finals, NML, Jamshedpur, April 2011; LGO-2013, NML, Jamshedpur, Feb 2013; MMCA-2013, NML, Jamshedpur, Nov 2013; STSP-2017, NML, Jamshedpur, October 2017

**LECTURES DELIVERED**

* Lecture entitled **“Uranium Hydrometallurgy”** at “Training Programme on Mineral Processing and Nonferrous Extractive Metallurgy” for Mgmt. Trainees of M/s UCIL, Jaduguda; held at NML, Jamshedpur from 30th June to 5th July 2008
* Keynote Lecture on **“Bioremediation and Resource Utilisation”** at “National Seminar on Environmental Bioremediation Technologies”, held at Bharathidasan University, Tiruchirapalli, India, 5-6Nov. 2009
* Invited Lecture on **“Microbial composites in effluent remediation”** at “Third International Multicomponent Polymer Conference”, held at MGU, Kottayam, India, 23-25 Mar. 2012
* National Science Day Lecture on **“Role of Biotechnology for Shaping Future of Science”** delivered at The Institution of Engineers, Jamshedpur, India, 6th Feb 2013.
* Invited Lecture on **"Mineral Biotechnology - an inherent tool for mining industry"** at Department of Microbiology and Biotechnology, Gujarat University, Ahmedabad, India, 22-23rd March 2013
* Invited lecture on **“Trends and issues in Science Research”** at National Workshop on Research Methodology in Basic Sciences, Engineering and Technology, organized by Associations of Indian Universities and Pt. Ravishankar Shukla University, Raipur, 29th Aug to 2nd Sept 2013, .
* Invited Keynote Lecture delivered on **“Thermophilic bioleaching of chalcopyrite”** at ICHM-2014, Beijing, China
* Invited Resource Lecture on **“Role of Microbiology in Minerals-Metals-Materials and Environment Sector”** at National Seminar on Dynamic Microbes at Modern College, Pune, India, 20-21st Feb 2015
* Invited Lecture on **“Applications of microbial biotechnology in metallurgical industries”** at BRSI’s National Seminar on Recent Advances in Biotechnology, IICB, Kolkata, India, 17th April 2015
* Invited Lecture on **“Recycling of HEV batteries”** at IITM's workshop on "Status of EV recycling in India", IIT, Madras, India, 25th November 2016
* Invited Speaker on **“Sustainable recycling of Mine and Urban Wastes by Environmentally Benign Options”** at International Symposium on Sustainability in Science and Engineering , organized by IITB, Ohio State University and TechStain, at IITB, 26th July 2017
* Invited Speaker at "International Conference on Advanced Engineering Functional Materials (ICAEFM 2017), Bhubaneswar, Odisha, India (21-23, Sep 2017)
* Invited Speaker at “3rd India International Science Festival (IISF-2017)”, 13-16th October 2017 **(Theme: Swaach Bharat; Topic: Sustainable End-of-life Closed Loop Recycling of Battery Wastes)**.
* Keynote Speaker at “17th International Conference on Mineral Processing Technology (MPT-2018), Dhanbad, Jharkhand (10-12th October 2018) (**Topic: Sustainable Extraction of Critical and Strategic Elements from Secondary Resources**)
* Invited Speaker at “23rd International Conference on Nonferrous Minerals and Metals (ICNFMM 2019), Kolkata (5-7th July 2019) (**Topic: Nonferrous Wastes for addressing critical elements**)
* Invited Speaker at “National Conference on Science and Technology for Rare Earth Applications (STAR 2019), BARC, Mumbai (5-7th Dec 2019) (**Topic: Interdisciplinary methods for extraction of REEs from secondaries**)
* Invited Speaker at “International Seminar on Mineral Processing Technology (MPT 2019), Hyderabad (16-18th Dec 2019) (**Topic: Microbial beneficiation of mineral and metallurgical wastes**)

**FOREIGN VISITS**

* **EGYPT:** MINERALS TO MATERIALS CONFERENCE - 2008, organized by Central Metallurgical Research and Development Institute (CMRDI), Egypt, 15-18 December, 2008.
* **AUSTRALIA:** ALTA-2010, organized by ALTA METl Services, Perth, Australia, 24-29 May, 2010.
* **RUSSIA:** Bilaterial Exchange visit Programme under Indo-Russian Collaboration and Oral Paper Presentation at IIIrd International Congress on Nonferrous Metals 2011 (31 Aug-14 September, 2011) in Krasnoyarsk, Russia.
* **CHINA:** 3rd International Conference on Asian Nuclear Prospects (ANUP-2012), organized by Tsinghua University (Beijing), INS, IAEA, CAN and KAERI, 16-19 October, 2012.
* **CHINA:** XXVIth International Symposium on Environmental Biogeochemistry (ISEB-2013), Wuhan, China, 13-18 October, 2013.
* **CHINA:** 6th International Conference on Hydrometallurgy (ICHM-2014), Beijing, China, 16-19 October, 2014.

**TRAINING UNDERTAKEN**

* School on Mineral Biotechnology, at IISC, Bangalore in Dec 2009
* Short Course on Heap Leaching at ALTA 2010, Perth, May 2010.
* Change Leaders Workshop, at NML, Jamshedpur in August 2010
* Training Program on Technology Valorization & Management, at ASCI, Hyderabad in Feb 2011.
* Career Development Workshop, M/s Groman Consulting S.A., at NML, Jamshedpur, Dec 2011.

**STUDENTS GUIDANCE/TRAINING IMPARTED**

* Classes for ACSIR students, New Recruit Scientists and National/International Interns
* *Summer Training* : 45 (B.Tech/B.Sc./M.Sc.)
* *Dissertation* : 30 (M.Sc.); 03(M.Tech)
* *Mentorship* (IAS-IASc-NASI) : 04 (B.Tech/M.Sc)

**REFEREES**

1. Dr.B.D.Pandey, Former Chief Scientist and Head, Metal Extraction & Forming Division, CSIR-NML, Jamshedpur, INDIA; Email: bdpnml@gmail.com
2. Prof. K.A.Natarajan, NASI Fellow and Hon. Professor, Dept. of Materials Engg., IISC, Bangalore, INDIA; Email: kan@materials.iisc.ernet.in
3. Professor Ata Akcil, *Group Leader,* Mineral - Metal Recovery and Recycling (MMR&R) Research Group, S.D. University, TURKEY; Email: ataakcil@sdu.edu.tr
4. Prof. Axel Schippers, Head, Geomicrobiology Unit, Resource Geochemistry, Federal Institute for Geosciences & Natural Resources (BGR), Hannover, GERMANY; Email: axel.schippers@bgr.de