Prof. Rajiv Shekhar
Department of Materials Science and Engineering
Indian Institute of Technology Kanpur, Kanpur 208 016
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Education

B.Tech. (Metallurgical Engg.): Indian Institute of Technology (IIT) Kanpur, 1982.
MS (Metallurgical Engg.): University of California, Berkeley, 1985.
PhD (Metallurgical Engg.): University of California, Berkeley, 1988.

Professional strengths

- 24 years of teaching and research experience at IIT Kanpur with focus on industrial applications.
- Well-rounded, go-getter academic with experience ranging from institution building, engineering R&D, project management, policy, and administration.
- Good contacts in industry, R&D organizations, and multi-lateral institutions.
- Multi-disciplinary expertise: metals extraction, manufacturing, environmental remediation, engineering economics, solar thermal energy, electric power system optimization and policy.
- Good understanding of process for scaling technology from laboratory to industry.
- Unflinching loyalty to the organization and impeccable professional integrity.

Professional experience highlights

a) Research & Development
- Design of next-generation Hall-Heroult cell for aluminium smelting.
- Reactor design for electrochemical refining of spent nuclear fuel.
- Design of Pachuca tanks for leaching of ores.
- Design and application of solar thermal energy technology for metals processing.
- Technology for drilling cooling holes in inconel for turbine blades.
- In-situ remediation of heavy metal contaminated soil.

b) Leadership
- Established SIDBI Innovation and Incubation Centre, IIT Kanpur. It is rated among the best incubators in India.
- Set-up the Centre of Excellence in Solar Thermal Research and Education at IIT Jodhpur through a Rs. 40 crore grant from MNRE. Extensive collaboration with industry.
- Developed a comprehensive master plan for IIT Jodhpur.
- Transformed Dept. of Materials & Metallurgical Engg. , IIT Kanpur into one coherent unit.

c) Administration
- Head, Department of Materials & Metallurgical Engineering, IIT Kanpur.
- Faculty Advisor (Administration), IIT Jodhpur.
- Chairman, Health Centre Users Committee, IIT Kanpur.

d) Policy
- Member, Board of Governors, IIT Kanpur.
- Member, Institute Academic Review Committees.
- Associate Editor, India Infrastructure Report.

Detailed Curriculum Vitae

Date of Birth

June 25, 1960

Education

B.Tech. (Metallurgical Engg.): Indian Institute of Technology (IIT) Kanpur, 1982.
MS (Metallurgical Engg.): University of California, Berkeley, 1985.
PhD (Metallurgical Engg.): University of California, Berkeley, 1988.

Professional Experience

- Visiting Faculty (2012 – 2013), Indian Institute of Technology Jodhpur.
- Professor (2001 -): Materials Science and Engineering, IIT Kanpur.
- Associate Professor (1997 - 2001): Materials and Metallurgical Engineering, IIT Kanpur.
- Assistant Professor (1990 - 1997): Materials and Metallurgical Engineering, IIT Kanpur.
- Asst. Research Engineer (May 1988 - March 1990): University of California, Berkeley.

Area of Specialisation

Application of transport phenomena and electrochemistry for process/reactor design in extractive metallurgy, materials processing, pollution control, and solar thermal power.

Areas of Research

- Volumetric air receiver design for solar thermal energy generation.
- Electrochemical surface modification techniques
- Electrochemical refining of spent oxide and metallic nuclear fuels
- Electric power system optimization.
- Electroremediation of heavy metal contaminated soils
- Electrochemical drilling of deep cooling holes in turbine blades
- Electrochemical deposition of magnetic multilayers for GMR applications
- Design of Hall-Heroult cells for primary aluminium production.
- Design of Pachuca tanks for leaching of uranium ores.

Major Research Achievements

- Design of next-generation Hall-Heroult cell for aluminium smelting.
- Design of Pachuca tanks for leaching of uranium.
- Design and fabrication of volumetric air receiver based solar thermal system.
- Process for drilling contoured deep hole in super alloys using STED to enhance cooling in turbine blades.
- Electroremediation of heavy metal contaminated soils.

Teaching Experience

Introduction to Manufacturing Processes (UG-Core), Metallurgical Kinetics (UG), Unit Operations in Extractive Metallurgy (UG), Process Plant Design for Metallurgical Engineering Operations (UG),

Heat and Mass Transfer (PG), Electrochemical Technology in Materials Processing (PG), Fluid Mechanics (for ME UG students at IIT Jodhpur).

Administrative Experience

a) Head, Centre for Solar Energy Technologies (1/2012 – 11/2013), IIT Jodhpur.
- Setting up a Centre of Excellence in solar thermal research and education through a major research grant from MNRE, Govt. of India.
- Fostered collaboration with industry on setting up solar thermal research projects.
  - Collaboration with Aditya Birla Science & Technology Company for solar thermal heating of commercial aluminium furnaces.
  - Collaboration with Indian Oil Corp. and Bharat Heavy Electricals Ltd. for setting up experimental solar thermal plant at IIT Jodhpur.
  - Partnership with BARC for setting up a 5 MW molten salt tower demonstration plant at IIT Jodhpur.
  - Setting up an International Centre for Solar Energy Technologies with funding from the Asian Development Bank.
  - Collaboration with STEAG Energy Services (India) Pvt. Ltd. For training engineering college faculty and students on a solar thermal simulator.

b) Coordinator, Centre of Excellence (CoE) Energy (1/2012 – 7/2013), IIT Jodhpur.
- Led the process for developing academic curriculum for CoE Energy.

c) Faculty Advisor (Administration, 5/2012 – 11/2013), IIT Jodhpur
- Streamlined Accounts and Stores & Purchase departments.

d) Faculty I/c Campus Development (4/2013 – 11/2013)
- As Chairman of the Project Management Group, I led the development of the master plan of IIT Jodhpur, probably one of the most comprehensive documents of its type for an educational institution.

e) Member (1/2010 – 12/2011), Board of Governors, IIT Kanpur.

f) Head (1/2006 – 1/2009), Dept. of Materials and Metallurgical Engineering, IIT Kanpur.
- Framed long-term research vision.
- Established mentoring system for academically deficient UG students.
- Industrial networking of new faculty.
- Doubling teaching laboratory facilities and laboratory modernisation.
- Scheme for optimal deployment and professional development of department laboratory staff.
- Introduced a transparent faculty hiring system.
- Streamlined the accounts and inventory system of the department.
- Overhauled laboratory safety systems.

g) Member, Institute Academic Review Committee (2000 and 2008).

h) Head, SIDBI Innovation and Incubation Centre, IIT Kanpur (2003 – 2006).
- Established the Business Incubator.
- Set-up the Intellectual Property Rights and Technology Transfer Office
- Organised experiential learning programs for students.
  - Started an Entrepreneurship Internship Programme for students of IIT Kanpur and other engineering colleges located in Kanpur.
  - Started an outreach centre for Technology Entrepreneurship Promotion Programme (TEPP).

i) Coordinator, Small-Scale Industries Cell, IIT Kanpur (2003 - 2006)
- New Business Opportunities workshops for Small-Scale industries Personnel from Kanpur.
- Skill-based extension courses for industry personnel and students from local colleges in Kanpur.

j) Chairman, Health Centre Users Committee, IIT Kanpur (2002 – 04)
- Implemented a new, cost-efficient health scheme for IIT Kanpur employees, which continues to this day.
- Reduced medicine budget by 20% by streamlining the medicine procurement system.

k) Treasurer, Students' Gymkhana, IIT Kanpur (2000 – 2002)
- Streamlined the accounts of Students' Gymkhana.

l) Member Civil Advisory Committee, Institute Works Department, IIT Kanpur (2000 – 2001).

m) Warden, Hall of Residence III, IIT Kanpur (1991 – 1994).

Sponsored Projects

1. "Establishing a centre of excellence in solar thermal research and education at IIT Jodhpur," MNRE, September 2011 – August 2016, Rs. 40 crores, (with several faculty from IIT Jodhpur). Was PI till November 2013.
2. "Development of the International Center for Application of Solar Energy Technologies," Asian Development Bank, January 2012 – June 2014, US$200,000, (with Dr. L. Chandra of IIT Jodhpur). Was PI till November 2013.
3. "Development of magnetic field sensors based on metallic multilayers with high magnetoresistive sensitivity," **ARMREB** (DRDO), October 2007 – September 2009, Rs. 22.65 lakhs (with Prof. M. Katiyar).
4. "Aqueous Nitriding of Steels by Electrolyte Plasma: Kinetics, Design, and Scale-up," **DST,** New Delhi, August 2007 – March 2010 (with Prof. R. C. Sharma and Prof. R. K. Thareja),Rs. 18.27 lakhs
5. "Molten salt electrodeposition of rare-earths and actinides," BRNS, DAE, Govt. of India, June 2004 – March 2008, Rs. 21.16 lakhs.
6. "Electroremediation of Heavy Metal Contaminated Soils: Pilot-Scale Studies for Technology Development," MHRD, Govt. of India, April 2003 – March 2005, Rs. 8 lakhs.
7. "Electrodeposition of magnetic multilayers with high giant magnetoresistance," **ARMREB** (DRDO), November 2002 – October 2005. (with Prof. M. Katiyar).
8. "The analysis of fused deposition through electrochemical discharge," **DST,** New Delhi, April 2002 - March 2005 (with Prof. A. Ghosh)
9. "Electroremediation of heavy metal contaminated soil: Design, scaleup and optimisation," **CSIR,** New Delhi**,** April 2000 - March 2003 (in collaboration with Regional Research Laboratory, Bhubaneshwar).
10. "Design and development of shaped tube pulse electrochemical machining for drilling deep microholes in inconel alloys," **Department of Science and Technology,** New Delhi, April 2001 - March 2003 (with Prof. V. K. Jain).
11. "Studies on magnetohydrodynamics in electrically driven melt flow," **Department of Science and Technology,** New Delhi, April 1995 - March 2001 (with Prof. S. P. Mehrotra).
12. "Reclamation of values from industrial wastes and effluents," **AICTE,** New Delhi, April 1995 - March 1999 (with Prof. S. P. Mehrotra).
13. "Design, scaleup and optimisation of Pachuca tanks**," BRNS**, **Department of Atomic Energy,** April 1992 - June 1995 (with Prof. S. P. Mehrotra).

Consultancy Projects

1. "Identification of suitable business opportunities," **Shree Cements Pvt. Ltd., Kolkata**, Rs. 6.35 lakhs, April 2010 – September 2010.
2. "Modelling of the electrorefining cell in the pyroprocessing demonstration facility," **IGCAR, Kalapakkam**, Rs. 15.0 lakhs, April 2008 – March 2010.
3. "Determining the commercial feasibility of manufacturing silicon and a mineral-related plant," **Shree Cements Pvt. Ltd., Kolkata**, Rs. 1.34 lakhs, March 2008 – October 2008.
4. "Day ahead auction software for power exchange," **National Commodity & Derivatives Exchange Limited (NCDEX)**, Mumbai, Rs. 5.0 lakhs, October 2006 – February 2007 (with Prof. P. K. Kalra).
5. "Prefeasibilty studies for identifying training needs by electric distribution utilities**," Institute of International Education (IIE)**, Washington, D.C. (U.S.A.), Rs. 5.0 lakhs, May 2004 (with Prof. P. K. Kalra).
6. "Development of an integrated software platform for evaluating Environmental Impact Assessment reports of thermal power plants," **Infrastructure Development and Finance Company, Mumbai**, Rs. 8.0 lakhs, August 2000 - August 2002
7. "Achieving refractory consumption of international benchmark level in integrated steel plants," **RDCIS, SAIL,** Ranchi, Rs. 13.0 lakhs, October 1999 - June 2002 (with Prof. N. N. Kishore and Prof. P. K. Kalra).
8. "Use of slotted anodes to achieve power saving in pots of HINDALCO," **Accenture Inc.,** New Delhi, Rs. 0.75 lakhs, January 2001 – February 2001.

Patents

1. V. K. Jain, D. S. Bilgi, A. V. Kulkarni, A. Chavan, R. Shekhar: "Process for drilling contoured deep hole in super alloys using STED to enhance cooling in turbine blades," (Applied for, January 2007).

Publications in Refereed Journals

1. P. K. Sharma, R. Sarma, L. Chandra, R. Shekhar, P. S. Ghoshdastidar: "On the design and evaluation of open volumetric air receiver for process heat applications, Solar Energy, doi:10.1016/j.solener.2015.05.027, 2015.
2. Ajeet K Srivastav, Rajiv Shekhar: "Nucleation and growth mechanism of Co-Pt alloy nanowires electrodeposited within alumina template," Journal of Nanoparticle Research, doi:10.1007/s11051-014-2858-4, 2015.
3. P. Sharma, R. Sarma, L. Chandra, R. Shekhar, P. S. Ghoshdastidar: "Solar tower based aluminium heat treatment system: Part I. Design and evaluation of an open volumetric air receiver," Solar Energy, v 111, 2015, pp. 135-150.
4. D. Patidar, S. Tiwari, P.K. Sharma, L. Chandra, R. Shekhar: "Open volumetric air receiver based solar convective aluminum heat treatment furnace system," Energy Procedia, v 69, 2015, pp. 506-517.
5. V. Kumar, Govind, K. Philippe, K. Balani: "Processing and nano-mechanical characterization of Mg-Li-Al based Alloys," Procedia Materials Science, v 5, 2014, pp. 585–59.
6. N. Gupta, R. Shekhar, P. K. Kalra: "Computationally efficient composite transmission expansion planning: a pareto optimal approach for techno-economic solution," accepted for publication, International Journal of Electrical Power and Energy Systems, v 63, 2014, pp. 917-926.
7. A. K. Srivastav, R. Shekhar, "Crystal anisotropy induced temperature dependent magnetization in cobalt nanowires electrodeposited within alumina template," Journal of Magnetism and Magnetic Materials, v 349, 2014, pp. 21-26.

8. M. Karnik, A. Ghosh, R. Shekhar, "The mechanism of electrochemical discharge(ECD)," Key Engineering Materials, v 572, 2014, pp. 295-299.
9. N. Gupta, R. Shekhar, P. K. Kalra: "Probabilistic transmission expansion planning: congestion management based roulette wheel simulation for optimal capacity," International Journal of Electrical Power and Energy Systems, v 43, 2012, pp 1259-1266.
10. K. Sanjay, R. Shekhar: "Electroosmotic pump: "Rate controlling mechanism for unusually fast electroremediation kinetics of Cr(VI) in basic Kanpur soil," Electrochimica Acta, v 86, 2012, pp. 80-88.
11. V. Kumar, Govind, R. Balasubramaniam, R. Shekhar, K. Balani: "Microstructure evolution and texture development in thermomechanically processed Mg–Li–Al based alloys," Mater. Sci. Eng. A, v 547, 2012, pp. 38–50.
12. V. Kumar, R. Balasubramaniam, R. Shekhar, K. Balani: "Microstructure and texture evolution during hot rolling of Mg-9Li-7Al-1Sn alloy for aerospace application," Material Science Forum, v 702-703, 2012, pp. 85-88.
13. K. Shiva Kumar, A. Roy, A. Raghunath, R. C. Sharma, R. Shekhar: "Feasibility and kinetics of nitriding of pure titanium and Ti-6Al-4V in the molten salt bath of potassium nitrate Surface Engineering," Surface Engineering, v 28, 2012, pp. 458-463.
14. K. Sanjay, R. Shekhar: "Electrokinetic cleaning of industrial residues," Trans. Inst. Min. Metall. C, v 121, 2012, pp. 117-120.
15. V. Kumar, Govind, R. Shekhar, K. Balani: "Effect of hot rolling on microstructure and texture evolution of Mg-Li based alloy," Material Science Forum, v 690, 2011, pp. 347-350.
16. M. Karnik, A. Ghosh, R. Shekhar, "Polarity dependence of the electrochemical discharge(ECD)," Key Engineering Materials, v 486, 2011, pp. 131-134.
17. R. Thudum, A. Srivastava, S. Nandi, A. Nagaraj, R. Shekhar: "Molten salt electrolysis of neodymium: electrolyte selection and deposition mechanism," Trans. Inst. Min. Metall. C, v 119 (2), 2010, pp. 88-92.
18. M. Karnik, A. Ghosh, R. Shekhar: "Fused deposition process combining electrochemical discharge with high speed selective jet electrodeposition," Trans IMF, v 87 (5), 2009, pp. 264-271.
19. A. Roy, S. J. Parihar; A. Singh, R. C Sharma, R. Shekhar: "Quench hardening of 0.4 % C steel by using aqueous electrolyte plasma as heat source," Surface Engineering, v 25 (6), 2009, pp.423-429.
20. D. Pradhan, T. Sripadmini, P. Pradhan, M. Katiyar, and R. Shekhar: "Effect of electrode configuration and mode of deposition on magnetoresistance in electrodeposited Co/Cu multilayers on n-Si by a fully electrochemical method," Electrochimica Acta, v 54 (2), 2008, pp. 430-433.
21. D. S. Bilgi, R. Kumar, V. K. Jain, R. Shekhar: "Predicting Radial Overcut in Deep Holes Drilled by Shaped Tube Electrochemical Machining," International Journal of Advanced Manufacturing Technology, v 39 (1-2), 2008, pp. 47-54.
22. A. Roy, R. K. Tewari, R.C. Sharma, R. Shekhar: "Aqueous electrolyte plasma nitriding: A feasibility study," Surface Engineering, v 23, 2007, pp. 243-246.
23. S. N. Lenka, S. P. Mehrotra, R. Shekhar: "Magnetohydrodynamics in advanced Hall-Heroult cells: Physical modelling of flow in a laboratory-scale cell, Trans. Inst. Min. Metall. C, v 116, 2007, pp. 177-182.
24. D. Bhunia, S. P. Mehrotra, R. Shekhar: "A novel probe for measuring current distribution in wood's metal in a simulated Hall-Heroult cell," Trans. Inst. Min. Metall. C, v 115**,** 2006, pp. 206-212.
25. M. Sankar, N. K. Batra, R. Shekhar, and S. P. Mehrotra: "Roasting, reduction and leaching of Indian ilmenite ore for producing synthetic rutile," Trans. Indian Institute of Metals, v 59, 2006, pp. 381-387.
26. D. S. Bilgi, V. K. Jain, R. Shekhar, A. V. Kulkarni: "Hole quality and interelectrode gap dynamics during pulse current electrochemical deep hole drilling," International Journal of Advanced Manufacturing Technology, v. 34, 2007, pp. 79-95.
27. D. S. Bilgi, V. K. Jain, R. Shekhar, S. Mehrotra:" Electrochemical deep hole drilling in super alloy for turbine application," Journal of Materials Processing Technology, v 149, 2004, pp. 445-452

28. K Sanjay, A Arora, R Shekhar and R P Das: “Electroremediation of Cr(VI) Contaminated Soils: Kinetics and Energy Efficiency,” Colloids and Surfaces A: Physicochemical and Engineering Aspects, vol. 222, 2003, pp. 253-259
29. M Manna, K Sanjay, R Shekhar: “Electrochemical Cleaning Of Soil Contaminated With A Dichromate Lixiviant,” International Journal of Mineral Processing, vol. 1696, 2003, pp.
30. S. Sharma, V. K. Jain and R. Shekhar: “Electrochemical drilling of inconel superalloy with acidified NaCl electrolyte,” International Journal of Advanced Manufacturing Technology, vol. 19, 2002, pp. 492 – 500.
31. S. P. Mehrotra and R. Shekhar:"Particle suspension in air-agitated Pachuca tanks: Investigation of hysterisis and a novel split air injection technique," Metallurgical and Materials Transactions B, vol. 32B, April 2001, p. 223.
32. G. G. Roy, R. Shekhar and S. P. Mehrotra: "Particle suspension in (air-agitated) Pachuca tanks," Metallurgical and Materials Transactions B, vol. 29B, April 1998, p. 339.
33. T. Chandrashekhar, R. Shekhar and S. P. Mehrotra: "Solid-liquid mass transfer in air-agitated Pachuca tanks," Transactions of the Institution of Mining & Metallurgy, Section C, vol. 107, 1998, p. C151.
34. N. K. Nath, N. Chakraborti and R. Shekhar: "Reduction of Indian nickeliferrous ore with gas flowing vertically through the bed," Scandinavian Journal of Metallurgy, vol. 27, 1998, p. 14.
35. N. K. Nath, N. Chakraborti and R. Shekhar: "Reduction of Indian nickeliferrous ore with gas flowing horizontally over the bed," Scandinavian Journal of Metallurgy, vol. 26, 1997, p. 158.
36. G. G. Roy and R. Shekhar : "Oxygen mass transfer in (air-agitated) Pachuca Tanks: Part II: Mathematical modelling of mass transfer coefficients," Transactions of the Institution of Mining & Metallurgy, Section C, vol. 105, 1996, p. C16.
37. G. G. Roy and R. Shekhar: "Oxygen mass transfer in (air-agitated) Pachuca Tanks : Part I Laboratory-scale experimental measurements," Transactions of the Institution of Mining & Metallurgy, Section C, vol. 105, 1996, p. C9.
38. R. Shekhar and J. W. Evans: "Physical Modelling studies of electrolyte flow due to gas evolution and some aspects of bubble behaviour in Advanced Hall Cells: Part III Predicting the performance of advanced Hall cells," Metallurgical Transaction B., February 1996, p. 19.
39. N. K. Nath, N. Chakraborti and R. Shekhar: "Selective reduction of nickeliferrous ore : Part I Single pellet experiments," Scandinavian Journal of Metallurgy, vol. 24, 1995, p. 121.
40. R. Shekhar and J. W. Evans: "Physical Modelling studies of electrolyte flow due to gas evolution and some aspects of bubble behaviour in Advanced Hall Cells: Part II Flow and interpolar resistance in cells with a grooved anode," Metallurgical Transaction B., June 1994, p. 341.
41. R. Shekhar and J. W. Evans: "Physical Modelling studies of electrolyte flow due to gas evolution and some aspects of bubble behaviour in Advanced Hall Cells: Part I Flow in cells with a flat anode," Metallurgical Transaction B., June 1994, p. 333.
42. R. Shekhar and J. W. Evans: "Fluid flow and interpolar resistance measurements in Advanced Hall-Heroult cells," Mineral Processing and Extractive Metallurgy Review' Vol. 9, 1992. p. 135.
43. R. Shekhar and J. W. Evans: "Fluid flow in Pachuca (air agitated) tanks. Part II: Mathematical Modelling of flow in Pachuca Tanks." Metallurgical Transaction B., December 1990, p.191
44. R. Shekhar and J. W. Evans: "Fluid flow in Pachuca (air agitated) tanks. Part I: Laboratory-scale experimental measurements," Metallurgical Transaction B., December 1989, p.781.

Papers Submitted in Journals

1. Vinod Kumar, Rajiv Shekhar, Kantesh Balani:"Corrosion Study of multiphaseMg-9Li-7Al-1Sn and Mg-9Li-5Al-3Sn-1Zn alloys in NaCl aqueous solution," submitted to Metallurgical and Materials Transactions A, April 2014.
2. V. Kumar, K. Balani, R. Shekhar: Corrosion Study of novel Mg-9Li-7Al-1Sn and Mg-9Li-5Al-3Sn-1Zn alloys in NaCl aqueous solution," submitted to Journal of Alloys and Compounds, August 2014.

Papers Published in Conference Proceedings

1. D. K. Singh, R. Shekhar, P. K. Kalra: "Optimal load shedding: An economic approach," IEEE Region 10 Annual International Conference, Proceedings/TENCON, art. no. 5686763, 2010, pp. 636-639.
2. Vinod Kumar, V.S. Raja, Rajiv Shekhar, P. Mungole, P. P. Sinha, Kantesh Balani: "Electrochemical Corrosion study of Novel Mg-Li Alloys," International conference proceedings CORCON 2010 Corrosion Conference and Expo 2010, Goa, India, Sept. 23 - 26 2010.
3. N. Shukla, K. Sanjay, M. K. Harbola, R. Shekhar: "An electrochemical technique for minimizing soil and ground water contamination by heavy metals leached from solid industrial wastes," TMS Annual Meeting, 2010, pp. 285-292
4. Madhuri Karnik, R.Shekhar, and A.Ghosh: "Experimental study of fused deposition through electrochemical discharge," Proceedings of the 7th Japan-India Joint seminar, 2004,Tokyo, pp 111-118.
5. M Manna, K Sanjay, R Shekhar, and G. P. Bajpai: "Electroremediation of heavy metal contaminated soils," 18th National Convention of Environmental Engineers & National Seminar on Solid Waste management, Bhopal, October 19 – 20, 2002.
6. M G Sujana, Kali Sanjay and Rajiv Shekhar: 'Behaviour of Hexavalent Chromium During electroremediation," Proceedings of 39th National Metallurgists' Day and 55th Annual Technical Meeting of the Indian Institute of Metals, 18 – 21 Nov, 2001, pp. 301-302.
7. R. Shekhar and J. W. Evans: "Liquid velocities in air-agitated Pachuca tanks," in Hydrometallurgical Reactor Design and Kinetics, March 1986, New Orleans, Eds: R. G. Bautista, R. J. Wesley and G. W. Warren, The Metallurgical Society, 1986, p. 121.
8. R. Shekhar and J. W. Evans: "Fluid flow patterns in Pachuca tanks," Extraction Metallurgy 89, The Institution of Mining and Metallurgy, London, July 1989, p. 387.
9. R. Shekhar and J. W. Evans: "Modelling studies of electrolyte flow and bubble behaviour in advanced Hall cells," Light Metals, 1990, pp. 243-248.
10. G. G. Roy and R. Shekhar: "Oxygen mass transfer in Pachuca tanks," Hydrotech 93, Regional Research Laboratory, Bhubaneshwar, October 1993, p. 133.

Papers Presented in Conferences but not Published

1. G. Singh, D. Saini, L. Chandra, R. Shekhar: "Design of a cyclone separator for collection of dust from volumetric air receiver," FMFP2014, Indian Institute of Technology Kanpur, December 12-14, 2014
2. P. K. Sharma, R. Sarma, L. Chandra, R. Shekhar, P. S. Ghoshdastidar: "Effect of sand deposition on heat transfer in an open volumetric air receiver," SolarPACES, Las Vegas, 2013.
3. N. Yadav, L. Chandra, P. Pradeep Kumar and R. Shekhar: "Application of fluid dynamics for designing sub-systems in concentrated solar tower technology," Invited presentation, ICAFD, Botswana, 2012.
4. K. Sanjay and R. Shekhar: "Role of Mathematical Modeling in Designing Electroremediation Projects for the In-Situ Cleaning of Heavy Metal Contaminated Soils," International seminar on Mineral Processing Technology–2007 (MPT-2007), Indian Institute of Technology Bombay, Mumbai, February 22-24, 2007.
5. R. Shekhar and R. Misra: "Innovation and entrepreneurism in Indian universities: "A case study of the technology business incubator at the Indian Institute of Technology, Kanpur," Conference on "The Triple Helix Paradigm for Development: Strategies for Cooperation and Exchange of Good Practice", Bristol, UK, 17-19 September 2006.
6. K Sanjay, A Arora, R Shekhar and R P Das: "Electroremediation of heavy metal contaminated soils," International Symposium on Electrokinetic Phenomena, Cracow, Poland, August 18 – 22, 2002.
7. G. G. Roy, B. Basu, R. Shekhar and S. P. Mehrotra: "Mathematical modelling of heat flow and ledge profile in Hall-Heroult cells: Comparison of cells operated with semi-graphitic and

conventional anthracite cathode blocks," Annual meeting of Indian Institute of Metals, November 1996, New Delhi.
8. G. G. Roy, R. Shekhar and S. P. Mehrotra: "Particle suspension in Pachuca tanks," Annual meeting of Indian Institute of Metals, November 1994, Vishakapatnam.
9. N. K. Nath, N. Chakraborti and R. Shekhar: " Fixed bed pellet reduction under vertical gas flow condition," Annual meeting of Indian Institute of Metals, November 1994, Vishakapatnam.
10. N. K. Nath, N. Chakraborti and R. Shekhar: "Mathematical modelling for selective reduction of nickeliferrous ore in a fixed bed reactor," Annual meeting of Indian Institute of Metals, November 1993, Hyderabad

Chapters in Books/Reports

1. R. Shekhar: "Time to tap solar thermal energy," in **Financial Express**, 07/01/2015, New Delhi.
2. P. K. Kalra, R. Shekhar and V. Shrivastava: "Rural Electrification," in **India Infrastructure Report 2007,** 3I Network, Ed. A. Rastogi, Oxford University Press, New Delhi, 2007, p. 138.
3. P. K. Kalra and R. Shekhar: "Urban Energy Management," in **India Infrastructure Report 2006,** 3I Network, Ed. A. Rastogi, Oxford University Press, New Delhi, 2006, p. 190.
3. P. Chitkara, P. K. Kalra and R. Shekhar: "Preparedness of State Electricity Boards for Privatization," in ***Against The Current: Organizational Restructuring Of State Electricity Boards***, Ed. J. Ruet, Manohar Publishers/Centre De Sciences Humaines, New Delhi, 2003.
4. P. Chitkara, R. Shekhar and P. K. Kalra: "Inter-state transmission of electricity: lessons from the Northern regional grid collapse," **India Infrastructure Report 2002,** 3I Network, Eds. S. Morris and R. Shekhar, Oxford University Press, New Delhi.
5. P. Chitkara, R. Shekhar and P. K. Kalra: "Missing Interconnections in the Power Systems, **India Infrastructure Report 2001,** 3I Network, Ed. S. Morris, Oxford University Press, New Delhi, 2001, p. 94.

Thesis Supervision

PhD

Completed

1. D.Singh, 2012, "Combinational load shedding methodology for power distribution system," Dr. P. K. Kalra (Co-guide).
2. N. Gupta, 2012, "Transmission expansion planning," Dr. P. K. Kalra (Co-guide).
3. Vinod Kumar, 2011, "Microstructural, mechanical and electrochemical characterization of thermomechanically processed Mg-Li-Al based alloys" Dr. K.Balani, Dr. R. Balasubramaniam (Co-Guide).
4. K. Sanjay, 2008, "Electroremediation of Cr(VI) contaminated soils: Kinetics, design and scale-up."
5. M. Karnick, 2007, "Fused deposition through electrochemical discharge," Dr. A. Ghosh (Co-guide)
6. D. S. Bilgi, 2005, "Electrochemical deep hole drilling in superalloys" Dr. V. K. Jain (Co-guide).
7. G. G. Roy, 1996, "Gas liquid mass transfer and particle suspension in air-agitated Pachuca tanks."
8. N. Nath, 1995, "Reduction roasting of nickeliferrous ore in multiple hearth furnace," Dr. N. Chakraborti (Co-guide).

Ongoing

1. A. Gupta, "Flow modeling in Advanced Hall-Heroult Cells," Dr. B. Basu, ABSTL (Co-guide).
2. Piyush Sharma, "Volumetric air receiver design," Dr. P. Ghoshdastidar, Dr. L. Chandra, IITJ (Co-guides).

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34. D. S. Sastry, 1999, "Electrostream drilling of high speed steel," Dr. V. K. Jain (Co-guide).
35. M. Srivastava, 1998, "Experimental Studies of magnetohydrodynamics in a laboratory scale Hall-Heroult cell**,"** Dr. S. P. Mehrotra (Co-guide).
36. Renu Thakur, 1998, "Modelling of a muffle furnace used in Firozabad glass industry."
37. S. K. Subramanya, 1997, "Processing of alumina-zirconia composites via precipitation controlled pH conditions," Dr. R. Tandon (Co-guide).
38. T. Chandrashekhar, 1994, "Experimental studies on solid-liquid mass transfer in Pachuca tanks," Dr. S. P. Mehrotra (Co-guide).
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Conferences/Workshops/Short-Term Courses/Reports

1. Editor: **India Infrastructure Report 2002,** 3I Network, Eds. S. Morris and R. Shekhar, Oxford University Press, New Delhi.
2. Co-Convenor**: International Conference On Mineral Processing: Recent Advances and Future Trends**, December 11 - 15, 1995, IIT Kanpur
3. Co-ordinator: Short-term course on **Environmental Audit and Environmental Impact Assessment,** November 13 - 17, 1995 and January 13 - 18, 1997, IIT Kanpur.
4. "Smart grid technologies for renewable energy resources," IIT Jodhpur, April 23, 2012.
5. "Solar radiation resource assessment and modeling," IIT Jodhpur, August 7 – 9, 2012. Organized jointly with National Renewable Energy Laboratories (NREL), USA.
6. "Thermodynamic design of solar thermal power plants," Five hands-on training programme, each of 5 days duration, were conducted between December 2012 and November 2013 jointly with STEAG Energy Services (India) Pvt. Ltd.
7. International workshop on "Design of sub-systems for CSP Technologies," Jodhpur, December 19 – 21, 2013. Sponsored by the Asian Development Bank.