CV: Dr. Shashank Shekhar

Personal Information

Name: Dr. Shashank Shekhar

Date of Joining: May 5th, 2011

EMPLOYMENT HISTORY

Assistant Professor May 2011-Present
Department of Materials Science and Engineering, IIT Kanpur, India
Visiting Research Assistant Professor September 2010-April 2011
Department of Industrial Engineering, University of Pittsburgh, USA
Postdoctoral Research Associate July 2008- August 2010
Department of Industrial Engineering, University of Pittsburgh, USA
Mentor: Dr. M. Ravi Shankar

EDUCATION

PhD, School of Materials Engineering August 2001– December 2007
Purdue University, West Lafayette, IN, USA
Bachelor of Technology, Metallurgical Engg and Materials Sc. August 1997–May 2001
Indian Institute of Technology **(IIT)**, Bombay (Mumbai), INDIA

RESEARCH INTERESTS and SPECIALIZATION

Specialization: Grain boundaries and triple junctions, Thermomechanical Processing, Manufacturing, Physical Metallurgy

Areas of Interest:

- Structure, stability and mechanical properties of nanocrystalline materials obtained by Severe Plastic Deformation
- Grain boundaries, triple junctions and homophase interfaces in crystalline materials
- Thermomechanical processing of metals and alloys and its effect on microstructure and properties
- Modulated Machining and its effect on mechanical properties

Teaching

COURSES TAUGHT:

- Instructor, Materials Processing, MSE305, IIT Kanpur Jan-April 2018
- Co-Instructor, Manufacturing Lab, MSE315, IIT Kanpur Jan-April 2018
- Instructor, Dislocations and Plasticity MSE658, IIT Kanpur Aug-Nov 2017
- Co-Instructor, Lightweight alloys for automotive applications MSE672, IIT Kanpur Aug-Nov 2017
- Co-Instructor, Mechanical Behavior Lab MSE313, IIT Kanpur Aug-Nov 2017
- Instructor, Introduction to Manufacturing TA201, IIT Kanpur Jan-April 2017
- Tutor, Introduction to Manufacturing TA201, IIT Kanpur Jan-April 2017
- Co-Instructor, Research Skills CHE600, IIT Kanpur Jan-April 2017
- Instructor, Materials Processing, MSE305, IIT Kanpur Jan-April 2016
- Instructor, Manufacturing Lab, MSE315, IIT Kanpur Jan-April 2016
- Instructor, Dislocation and Plasticity, MSE658, IIT Kanpur Aug-Nov 2015
- Co-Instructor, Manufacturing Process Lab MSE315, IIT Kanpur Jan-April 2015
- Instructor, Introduction to Manufacturing TA201, IIT Kanpur Jan-April 2015
- Instructor, Introduction to Manufacturing TA201, IIT Kanpur Aug-Nov 2014
- Co-Instructor, MSE 300, IIT Kanpur Aug-Nov 2014
- Instructor, Grain Boundary Engineering MSE680, IIT Kanpur Jan-April 2014
- Co-Instructor, Research Skills CHE600, IIT Kanpur Jan-April 2014
- Instructor, Manufacturing Processes: Selection and Design MSE470, IIT Kanpur Aug-Nov 2013
- Co-Instructor, MSE 300, IIT Kanpur Aug-Nov 2013
- Instructor, MSE691 Jan-April 2013
- Instructor, Fundamentals of Materials Processing MSE370, IIT Kanpur Jan-April 2013
- Instructor, MSE691 Aug-Nov 2012
- Instructor, Fundamentals of Materials Processing MSE370, IIT Kanpur Jan-April 2012
- Tutor, Engineering Sciences (ESO 214), IIT Kanpur Aug-Nov 2011
- Tutor, Introduction to Manufacturing Process (TA201N), IIT Kanpur Aug-Nov 2011
- Co-Instructor, Manufacture of Structural Nanomaterials (IE 2012), University of Pittsburgh Fall 2010
- Co-Instructor, Manufacture of Structural Nanomaterials (IE 2012), University of Pittsburgh Fall 2009
- Teaching Assistant, Scanning Electron Microscopy (MSE 595B), Purdue University Fall 2005
- Teaching Assistant, Materials Properties Laboratory (MSE 235), Purdue University Fall 2004
- Teaching Assistant, Structure and Properties of Materials (MSE 230), Purdue University Spr 2002

COURSES DEVELOPED:

- Lightweight Alloys for Automotive Applications (MSE672)
- Dislocations and Plasticity (MSE658)
- Deformation Processing (MSE657)
- Materials Processing (MSE305)

Supervision of Bachelor/Master thesis

M. TECH STUDENTS

Mr. Asraful Haque "*Al-Si controlled expansion composites fabricated via pressureless sintering and SPS*" 2018

Mr. Amit Bhardwaj "*Pickling of Si and Cr containing Steels*" 2018

Mr. Ayush Anand "*Microstructural and Mechanical Characterization of High-Silicon Stainless Steel*" 2018

Mr. Ajay Soni "*Deformation processing maps for Al alloys for automotive applications*" 2018

Mr. G. Mani Ratnam, "*Effect of Machining on Mechanical, Tribological and Functional Properties of Mild Steel*" 2017

Mr. Raghvendra Tiwari, "*Effect of Co-deposition of Cu and Ni by Zn on alloying*" 2017

Mr. Pankaj Kumar, "Development of Very Hard Corrosion Resistant Roll bonded Cr Coating on Mild Steel in Presence of Graphite," 2017

Mr. Vipin Nanda, "*Effect of Machining on the Passivation Behavior of 304 SS Steel*" 2016

Mr. Randhir Kumar Parashar, "*Effect of Machining on Electrochemical Behavior of SS316L*" 2016

Mr. Ravi Joham, "*Effect of rolling and cross-rolling on grain boundary engineering of SS304*" 2016

Mr. Sanu Kumar Gupta, "*Effect of Machining on Abnormal Grain Growth during Oxidation of Mild Steel*" 2016

Mr. Abir Roy, "*Stress Corrosion Cracking Behavior of Severely Deformed Materials*" (MNIT, Allahabad) 2015

Mr. Miral Verma, "*Effect of Machining configurations on mechanical properties of SS316L*" 2014

Mr. Sudharm Rathore, "*Study of embrittlement behavior of Duplex Steel*" 2014

Ms. Paulami Majumdar, "*Effect of Machining on Corrosion Behavior of Steel*" 2014

Mr. Manish Prakash, "*Effect of Machining on Oxidation Behavior of Steel*" 2014

Mr. Koushik Sikdar, "*Fretting Wear of Mg-Li-Al based Alloys*" 2013

Ms. Monalisa Mandal (as co-ordinating guide), "*Effect of Micro-alloying and heat treatment on Corrosion Behavior of Cast Mg-Zn alloys*" 2013

UG STUDENTS

Mr. Abhishek Singh	Summer 2017
Mr. Gagandeep Kalshi (COEP)	Summer 2016
Ms. Saba Ahmad (CSJM)	2015-2016
Mr. Nikhil Tripathi (CSJM)	2015-2016
Mr. Ayush Singh Thapa (CSJM)	2015-2016
Mr. Gaurav Gupta (CSJM)	2015-2016
Mr. Rajat Gupta (CSJM)	2015-2016
Mr. Osama Ansar (RuTAG)	Summer 2015

Mr. Kislay Thakur (RuTAG)	Summer 2015
Ms. Ritika Sachan (RuTAG)	Summer 2015
Mr. G. Mani Ratnam	2015-2016 Sem-I and 2015 – 2016 Sem-II
Mr. Mithilesh Vaddadi	2015-2016 Sem-I
Ms. Nirma Kumari	2015 Summer and 2015-2016 Sem-I
Ms. Saloni Singhal (NIT Jaipur)	Summer 2015
Mr. Mrinal Dwivedi (Lucknow University)	Summer 2015
Mr. Nitin Kumar	2013-2014 Sem-II and 2014 – 2015 Sem-I
Mr. Sanu Kumar Gupta	2013-2014 Sem-II and 2014 – 2015 Sem-I
Mr. Ravi Joham	2013-2014 Sem-II and 2014 – 2015 Sem-I
Mr. Ankit Himanshu	2013-2014 Sem-II and 2014 – 2015 Sem-I
Mr. Abhishek Jain	2013-2014 Sem-II and 2014 – 2015 Sem-I
Mr. Randhir Kumar Parashar	2014 – 2015 Sem-I
Mr. Aviral Vaid	2012-2013 (Sem-I and Sem-II)
Ms. Kalpi Mittal	2012-2013 (Sem-I and Sem-II)
Mr. Awadhesh Kumar	2012-2013 Sem-I
Ms. Surbhi Singhania	2012-2013 Sem-I
Mr. Suchit Sarin, CSJM	2011-2012 (Sem-I and Sem-II)
Mr. Parth Ashok Garg, CSJM	2011-2012 (Sem-I and Sem-II)
Mr. Narendra Jhirwal	2011-2012 (Sem-I and Sem-II)
Mr. Anupam Acharya	2011-2012 (Sem-I and Sem-II)
Mr. Chirag Sidana	2011-2012 (Sem-I and Sem-II)
Mr. Amritansh Frank	2011-2012 (Sem-I and Sem-II)

PhD Supervision

Mr. Nitin Kr. Sharma, "*Experimental and theoretical study of evolution of grain boundary character distribution in face centered cubic alloys*" **(Graduated March 7th 2018)**

Mr. Sandeep Sahu, "*Effect of Thermomechanical Processing on Grain Boundary Character Distribution in Inconel 600*" **(SOTA Completed)** 2012 – Present

Mr. Biswajit Sengupta, "*Development of Low-cost Ti-Fe based Alloys for Structural Applications*" **(SOTA Completed)** 2013 – Present

Mr. Prabhat Chand Yadav, "*Microstructural evolution and GBCD evolution on machining of hard to deform materials*" **(SOTA Completed)** 2013 – Present

Mr. Prabhat Kumar Rai, "*Corrosion and Wear behavior of Harmonic Structured Metals and Alloys*" **(SOTA Completed)** 2015 – Present

Mr. Prince Setia, "Microstructure and mechanical characterization of High Silicon Steel" 2017 – Present

Mr. Nikhil Tripathi "Use of APT to study of effect of segregation in GBE" 2017 – Present

Knowledge Dissemination

CONFERENCES & WORKSHOPS

- Instructor, MOOC course on "Fundamentals of Materials Processes – PartII" July 2017
- Instructor, MOOC course on "Fundamentals of Materials Processes -PartI", July 2016
- Co-organizer, TEQIP Workshop on "Research Method and Skills", Feb 2016, IIT Kanpur
- Co-organizer, TEQIP Workshop on "High resolution x-ray and electron diffraction", Feb 2016, IIT Kanpur
- Co-organized Open house at ACMS for Electron Microscopy Lab, Jan 2016, IIT Kanpur
- Talk on "Research Skills and Methods", Dec 2015, IIT BHU.
- Talk at NRCM Conference on "Coincident Site Lattice related Boundaries and Critical Deviations", IISC Bangalore, Nov 2015.
- Co-organizer, TEQIP Workshop on "*Microstructure Engineering via Heat treatments*", Oct 2015
- Participated in TEQIP workshop on "*Materials and Metallurgy Curriculum*", Oct 2015, NIT Srinagar
- Conducted short-course on "Structure and Characterization of Materials" May 2015, NIT Srinagar
- Talk on "*Principles of Electron Microscopy*" and "*Principles of EBSD*" at TEQIP Workshop on "Structure and Characterization of Materials", Dec 2014, IIT Kanpur
- Co-organizer for Automotive Materials and Manufacturing Conference, April 2014, Pune
- Talk on "*Effective methodology for teaching materials science*" at TEQIP Workshop on Chemical and Materials Science, Feb 2014
- Conducted Workshop on "*Principles and Applications of EDS/ EBSD*" at Kalyani Center of Technological Innovation (Bharat Forge Ltd.) (May 2013), Pune
- Talk on "*Principles and Applications of Electron Microscopy*" at the QIP CDTE workshop on "Micro and Nano Fabrication" February 18th -22nd 2013, IIT Kanpur
- Talk on "*Advances in Nanostructured Materials Manufacturing and Nanomanufacturing Systems*" at SVNIT, Surat (June 2011). (Organized by Prof. B. Bidanda of University of Pittsburgh on Advances in Manufacturing Systems, as part of IUCEE program)

Publications

A. Published and accepted papers in peer-reviewed journals

A1. S. Sahu, P.C. Yadav, S. Shekhar, "*Use of hot rolling for generating low deviation twins and a disconnected random boundary network in Inconel 600 Alloy*," Met. & Mat. Trans A 49 (2) (2018), 628-643.

A2. N.K. Sharma, S. Shekhar, "*Deconvoluting error in measurement of low angle misorientation distribution*," Micron, 107 (2018) 28-34.

A3. P.C. Yadav, S. Sahu, A. Subramaniam, S. Shekhar, "*Effect of heat-treatment on microstructural evolution and mechanical behavior of severely deformed Inconel 718*," MSE-A, 715 (2018) 295-306

A4. B. Sengupta, S. Shekhar, K. Kulkarni, "*A novel concept for alloy design based on diffusional and thermodynamic interactions in multicomponent systems*" Philosophical Magazine Letters, DOI: 10.1080/09500839.2018.1472398

A5. P.K. Rai, S. Shekhar, "*Development of gradient microstructure in mild steel and grain size dependence of its electrochemical response*," Corrosion Science, https://doi.org/10.1016/j.corsci.2018.04.009

A6. Rama Satya Sandilya, P.K. Rai, S. Shekhar, S. Sangal, K. Mondal, "*A novel method for fabricating multilayered steels*," J. Mtls. Proc. Tech. 254 (2018) 38-51

A7. S. Sahu, P.C. Yadav, S. Shekhar, "*Fractal analysis as applied to fractography in ferritic stainless steel*," Metal, Micro. And Anal. 6(6) (2017) 598-609.

A8. P. Kumar, S. Khara, S. Shekhar, K. Mondal, "*Very hard corrosion-resistant roll-bonded Cr coating on mild steel in presence of graphite*," J. Mtls. Engg. Perf. 26(12) (2017) 5885-5896.

A9. B. Sengupta, S. Shekhar, K.N. Kulkarni, "*A novel ultra-high strength and low-cost as-cast titanium alloy*," MSE-A 696 (2017) 478-481.

A10. P.K. Rai, S. Shekhar, M. Nakatani, M. Ota, S.K. Vajpai, K. Ameyama, K. Mondal, "*Wear Behavior of Harmonic Structured 304L Stainless Steel*," J. Mtls. Engg. Perf. 26 (6) (2017), 2608-2618.

A11. N.K. Sharma, S. Shekhar "*Cut-off deviation for CSL boundaries in recrystallized face-centered cubic materials*," Phil Mag. 97 (23) (2017) 2004-2017.

A12. R. Joham, N.K. Sharma, K. Mondal, S. Shekhar, "*Low temperature cross-rolling to modify grain boundary character distribution and its effect on sensitization of SS304*," J. Mtls. Proc. Tech. 240 (2017) 324-331.

A13. S. Choudhary, V. Nanda, S. Shekhar, A. Garg, K. Mondal, "*Effect of Microstructural Anisotropy on the Electrochemical Behavior of Rolled Mild Steel*, " J. Mtls. Engg. Perf. 26 (1) (2017), 185-194.

A14. N.K. Sharma, S. Shekhar, "*Microstructure and Property Evolution for Hot-Rolled and Cold-Rolled Austenitic Stainless Steel 316L*," Transactions of IIM 70 (5) (2017) 1277-1284.

A15. N.K. Sharma, S. Shekhar, "*User-independent EBSD parameters to study the progress of recovery and recrystallization in Cu-Zn alloy during in-situ heating*" J. Microscopy 264 (3) (2016), 362-369.

A16. P.K. Rai, S. Shekhar, M. Nakatani, M. Ota, S.K. Vajpai, K. Ameyama, K. Mondal, "*Effect of Harmonic Microstructure on the Corrosion Behavior of SUS304L Austenitic Stainless Steel*," Met & Mat. Trans A 47 (12) (2016), 6259-6269.

A17. P.C. Yadav, A. Sinhal, A. Roy, S. Sahu, S. Shekhar, "*Microstructural Inhomogeneity in Constrained Groove Prssed Cu-Zn Alloy Sheet*" J. Mtls. Engg. Perf. 25 (7) (2016), 2604-2614.

A18. A. Vaid, K. Mittal, S. Sahu, S. Shekhar, "*Controlled Evolution of Coincidence Site Lattice Related Grain Boundaries*", Transactions of IIM 69 (9) (2016), 1745-1753.

A19. M. Prakash, A.P. Moon, K. Mondal, S. Shekhar, "*Effect of Machining Configurations on the Electrochemical Response of Mild Steel in 3.5% NaCl Solution*", J. Mtls Engg. Perf. 24(9) (2015) 3643-3650.

A20. P. Majumdar, S. Shekhar, K. Mondal, "*Effect of Machining Parameters on Oxidation Behavior of Mild Steel*", J. Mtls. Engg. and Perf. 24 (2015) 484-498.

A21. K. Sikdar, S. Shekhar, K. Balani, "*Fretting Wear of Mg-Li-Al Alloys*", Wear 318 (2014), 177-187.

A22. M. Prakash, S. Shekhar, A.P. Moon, K. Mondal, "*Effect of Machining Configuration on the Corrosion of Mild Steel*", J. Mtls. Proc. Tech. 219 (2014) 70-83.

A23. M.B. Perry, J.P. Kharoufeh, S. Shekhar, J. Cai, M.R. Shankar, "*Statistical Characterization of Nanostructured Materials from Severe Plastic Deformation in Machining*," IIE Transactions, 44, 7 (2012), 534-550.

A24. S. Shekhar, J. Cai, S. Basu, S. Abolghasem, and M.R. Shankar, "*Effect of Severe Plastic Deformation in Machining Elucidated via Rate-Strain-Microstructure (RSM) Mappings,"* ASME Journal of Manufacturing Science and Engineering, 134 (2012) 031008.

A25. S. Abolghasem, S. Basu, S. Shekhar, J. Cai, M.R. Shankar "*Mapping Microstructures from Severe Plastic Deformation in Machining*" Transactions of North American Manufacturing Research Institute/Society of Manufacturing Engineers (NAMRI/SME), 40 (2012) 406-413.

A26. S. Abolghasem, S. Basu, S. Shekhar, J. Cai, M.R. Shankar "*Mapping Subgrain Sizes Resulting from Severe Simple Shear Deformation,"* Acta Met. 60 (2012) 376-386.

A27. S. Shekhar, S. Abolghashem, S. Basu, J. Cai, M. Ravi Shankar, *"Interactive Effects of Strain, Strain-rate and Temperature on Microstructure Evolution in High Rate Severe Plastic Deformation",* Materials Science Forum 1517 (702-703) (2012) 139-142

A28. S. Shekhar, J. Cai, S. Basu, S. Abolghasem, and M.R. Shankar, "*Effect of Strain-rate in Severe Plastic Deformation on Microstructure Refinement and Stored Energies*," J. Mater. Res. 26 (2011) 395-406.

A29. S. Shekhar, S. Abolghasem, S. Basu, J. Cai and M.R. Shankar, "*Generating Micro and sub-Micro Scale Surface Features using Modulated Machining in Compliant Systems*," Transactions of North American Manufacturing Research Institute/Society of Manufacturing Engineers (NAMRI/SME), 38 (2010) 299-306.

A30. S. Shekhar, J. Cai, J. Wang and M. R. Shankar, "*Multimodal Ultrafine Grain Size Distributions from Severe Plastic Deformation at High Strain Rates*," Materials Science and Engineering A, 527 (2009) 187-191.

A31. J. Cai, S. Shekhar, J. Wang and M. Ravi Shankar, "*Nanotwinned microstructures from low SFE brass by HRSPD*," Scripta Materialia, 60 (2009) 599-602.

A32. S. Shekhar, J. Cai, S. Lee, J. Wang and M. R. Shankar, "*How Strains and Strain-Rates are Accommodated by Dislocations and Twins During Chip Formation by Machining*," Transactions of North American Manufacturing Research Institute/Society of Manufacturing Engineers (NAMRI/SME), 37 (2009) 637-644.

A33. S. Shekhar, Alexander H. King, "*Strain Fields and Energies of Grain Boundary Triple Junction*," Acta Materialia, 56 (2008) 5728-5736.

A34. Alexander H. King, S. Shekhar, "*What Does it Mean to be Special? The Significance and Application of the Brandon Criterion*", Journal of Materials Science, 41 (2006) 7625-7682.

A35. R. Kremer, R. Narayanan, S. Shekhar and Alexander H. King, "*On the Design of Controlled Tricrystal Specimens for the Systematic Investigation of Static Grain Boundary Triple Junction Properties*," J. of Materials Science, 40 (2005) 2795-2802.

B. Published and accepted in peer-reviewed conference proceedings

B1. P.C. Yadav, S. Shekhar, "Enhanced strength of Inconel 718 by high rate severe plastic deformation," Proceedngs of 2018 Superalloy 718 & Derivatives: Energy, Aerospace, and Industrial Applications. ISBN 978-319-89480-5. (DOI 10.1007/978-3-319-89480-5_35) p. 541-552.

B2. G. Mani Ratnam, Manish Prakash, K. Mondal, S. Shekhar, "*Machining as a Thermomechanical process to Modulate functional and Mechancial Behavior of Steel*", SimPro 2016, RDCIS, Ranchi.

B3. P K Ajeet Babu, M R Saraf, Suraj Mani Chaurasiya, Suhail M Mulla, S. Shekhar, K. Kulkarni, "*Forging of Lightweight shaft and the assessment of Residual Stresses on the Forged Parts*", SimPro 2016, RDCIS, Ranchi.

B4. M. Verma, S. Shekhar, "Machining as a Thermomechanical Processing Technique and its Application for Surface Modification of Stainless Steel 316L" Proceedings of Indian Conference on Applied Mechanics (INCAM) (2016).

B5. Sandeep Sahu, S. Shekhar, "*Evolution of CSL Boundaries in Nickel Alloy by Iterative and Non-iterative thermomechanical Processing*", MS&T 2015.

B6. Prabhat Chand Yadav, S. Shekhar, "*Effect of heat treatment on microstructural inhomogeneity of Constrained Groove Pressed Cu-Zn alloy*", MS&T 2015.

B7. Nitin Kumar Sharma, S. Shekhar, "*In-situ study of Deviation of Σ3 Coincident Site Lattice Boundaries during Recrystallization of Cu-Zn Alloy*", MS&T 2015.

B8. Miral Verma, S. Shekhar, "*Machining as a Thermomechanical process and its Application for Surface Modification of Stainless Steel 316L*" July 2015, INCAM, IIT Delhi.

B9. Abir Roy, Abhishek Kumar, S. Shekhar, "*Mechanical behavior of Al 5083 processed by Constrained Groove Pressing*", National Conference on Product Design and Manufacturing (NCPDM 2015)

B10. Abir Roy, Abhishek Kumar, S. Shekhar, "*Corrosion behavior of severely deformed Al 5083*", Conference on Advance Materials and Processing (CAMP-2015)

B11. S. Shekhar, Alexander H. King, "*Read-Shockley Grain Boundaries and the Herring Equation*," Mater. Res. Soc. Symp. Proc., 1090E (2008) 1090Z05-18.

C. Manuscripts under review

C1. S. Sahu, N.K. Sharma, Sanjeev K. Patel, K. Mondal, S. Shekhar, "*Evolution of grain boundary structure during thermomechanical processing and its effect on sensitization behavior in a Nickel-based superalloy*", submitted to Journal of Materials Science.

C2. Prabhat K. Rai, S. Shekhar, K Mondal, "*Effects of grain size gradients on the fretting wear of a specially-processed low carbon steel against AISI E52100 bearing steel*" submitted to Wear.

C3. P.C. Yadav, S. Sahu, P. Bremond, S. Shekhar, "*Modeling and Verification of Temperature rise during Machining*," submitted to Current Science.

C4. S. Abolghasem, S. Basu, S. Shekhar, M. Ravi Shankar, "*Mapping dislocation densities resulting from severe plastic deformation using large strain machining*", submitted to JMR.

D. Manuscripts under preparation

D1. Mani Ratnam Gidla, S. Shekhar, "*Influence of Residual Stress and Surface roughness in deciding Fatigue life of 0.2%C steel in machining process*".

D2. N.K. Sharma, S. Shekhar, "*Evolution of annealing twins during recrystallization and grain growth of cold-rolled 316L stainless steel*".

D3. P. C. Yadav, S. Shekhar, "*Effect of heat treatment on microstructural inhomogeneity of CGP processed Cu-Zn alloy*".

Development

Method of Producing Multi-layered Steel with variable compositions, V.R.S. Sandilya, S. Khara, S. Sangal, S. Shekhar, K. Mondal (May 2017), Patent accepted by SIIC.

Method of fabrication based on controlled microstructure with refined and coarse grains: P.K. Rai, S. Choudhary, S. Shekhar, K. Mondal (Feb 2017), Patent accepted by SIIC.

Single – axis modulated cutting tool holder: Designed and developed a modulated cutting tool holder capable of giving modulation of the order of 90 μm with frequency in the range of few Hertz to few thousands of Hertz. This work was carried out at University of Pittsburgh.

Design for two-axes modulated cutting-tool holder: This design allows modulation in two axes while cutting on lathe machine. The modulation can be obtained along cutting direction as well as feed direction. Modulated cutting in two axes can create not only two-dimensional surface feature, but also lead to microstructural variation in two axes and together these can lead to interesting functional properties.

Funding (as PI)

Title: Microstructural and Mechanical Characterization of High -Silicon Stainless Steel
Sponsoring Agency: Indian Space Research Organization (ISRO-VSCC)
PI: Dr. S. Shekhar (Co-PI: Dr. Sudhanshu Shekhar Singh)
Grant: Rs. 25.776 L
Duration March 2017 – March 2020

Title: Microstructural and Tribological characterization of stainless steel 316L obtained by modulated machining
Sponsoring Agency: BRNS, DAE
PI: Dr. S. Shekhar (Co-PI: Dr. Gouthama, Dr. J. Ramkumar)
Grant: Rs. 74.1 L
Duration Aug 2016 – Aug 2019

Title: Effect of Heat Treatment on the Mechanical Properties of Thermomechanically Processed Russian grade 12X21H5T Duplex Steel (Phase-II)
Sponsoring Agency: Indian Space Research Organization (ISRO-VSCC)
PI: Dr. S. Shekhar
Grant: Rs. 8.4 L ;
Duration: March 2016- Aug 2017 **(Completed)**

Title: Effect of Heat Treatment on the Mechanical Properties of Thermomechanically Processed Russian grade 12X21H5T Duplex Steel (Phase-I)
Sponsoring Agency: Indian Space Research Organization (ISRO-VSCC)
PI: Dr. S. Shekhar
Grant: Rs. 14.56 L
Duration: March 2013- March 2015 **(Completed)**

Title: Microstructural Evaluation of deformation and recrystallization behavior
Sponsoring Agency: General Electric
PI: Dr. S. Shekhar
Grant: Rs. 6.0 L
Duration Sep 2015-Sep 2016 **(Completed)**

Funding (as Co-PI)

Title: Development of Controlled Expansion Alloys
Sponsoring Agency: Indian Space Research Organization (ISRO-VSCC)
PI: Dr. K. Mondal; Co-PI: Dr. S. Shekhar
Grant: Rs. 24.74 L
Duration: Aug 2017 – July 2019

Title: Layered Steel for Structural Applications
Sponsoring Agency: MHRD-DIC
PI: Dr. K. Mondal; Co-PI: Dr. S. Shekhar
Grant: Rs. 13.6L
Duration: July 2017 – July 2019

Title: High Strength, wear and Corrosion resistant steel for high speed rail and elastic clip Railway applications
Sponsoring Agency: MHRD-IMPRINT
PI: Dr. K. Mondal Co-PI: Dr. S. Shekhar, Dr. S. Sangal, Dr. C.S. Upadhyaya, Dr. S. Sankaran, Dr. S. Bhattacharyya, Dr. S. Suwas, Dr. C. Srivastava
Grant: Rs. 3.96 Crores
Duration: Feb 2017 – Feb 2020

Consultancy

Title: Investigating cause of Intergranular fracture
Sponsoring Agency: BHEL, Hardwar
PI: Dr. S. Shekhar
Grant: Rs. 50,313
Duration: July 2016 – Sep 2016 **(Completed)**

Title: Intergranular fracture determination using Fractal Method
Sponsoring Agency: BHEL, Hardwar
PI: Dr. S. Shekhar
Grant: Rs. 64,125
Duration: June 2015 – Sep 2015 **(Completed)**

Title: Making of cake from lead grids
Sponsoring Agency: Verdeen Chemicals, Ghaziabad, India
PI: Dr. S. Shekhar, Co-PI: Dr. K. Mondal
Grant: Rs. 2.15 L
Duration: Feb 2016 – April 2016 **(Completed)**

Title: Study and Development of Lightweight Forging Process for Automotive Components
Sponsoring Agency: Automotive Research Association of India – Forging Industry Division
PI: Dr. K. Kulkarni, Co-PI: Dr. S. Shekhar
Grant: Rs. 5.62 L
Duration: 2015-2017 **(Completed)**

Peer Recognition

1. **Invited talk on** "*Electron back-scatter diffraction (EBSD) as a tool and its limitations"* NMD-ATM 2017, Goa.
2. **Invited talk on** *"Microstructural Engineering of Inconel Alloys"* at Microstructural Engineering Conference at IIT Bombay Aug 20-21st 2017.
3. **Keynote speaker** for SimPro2016
4. **Invited talk on** "*Coincident Site Lattice related Boundaries and Critical Deviations,"* NRCM 2015, IISc Bangalore.
5. Letter of Recognition for '**Excellence in Teaching**' for the course TA201 Introduction to Manufacturing (2014-15 SemII)
6. Letter of Recognition for **'Excellence in Teaching'** for the course MSE 313 "Mechanical Behavior Lab' (2017-18 SemI).
7. **Invited talk on** "*ICME for Steel: Handshakes for Industrial Adoption*", NMD-ATM 2015.
8. **Invited talk on** "*Machining as a Route to Surface Engineering of Metals and Alloys to Enhance its Mechanical and Functional Properties*", Feb 2014, ICEMP, CSIR-IMMT Bhubaneswar.
9. **Invited talk on** "*Microstructural Engineering*," April, 2012, Annual General Body Meeting of Indian Institute of Metals, Kanpur Chapter.
10. **Invited talk on** *"Multifunctional Nanostructured Metals by High-rate Severe Plastic Deformation (HRSPD),"* Jan 2012, General Motors Research Center, Bangalore
11. **Invited talk on** *"Machining as a route for Severe Plastic Deformation,"* UGC-NRC-M Symposium on Mechanical Behavior of Materials' Jan 2012, Indian Institute of Science, Bangalore
12. **Invited talk on** "*Minimizing Metal Working Fluid in Metal Cutting Processes by Modulated Machining Technology*," AHMP 2009, San Diego.

13. Won “Best Poster Award” in the symposium, for the poster on “*Read-Shockley Grain Boundaries and the Herring Equation*” at MRS Spring 2008 Meetings, San Francisco, CA.
14. **Invited talk on** “*What does it mean to be Special?*,” 2006 TMS Annual Meeting: Brandon Symposium. (presented by A.H. King)

Contributions to the Institute

- Student Placement Coordinator (along with Prof. R. Shekhar) 2016-2017.
- Student Placement Coordinator (along with Prof. M. Katiyar): Organized workshop for students on “Prepping for Interview” in 2015.
- DUGC: I have been an active member of DUGC from the time I joined the Institute. I also served as Convener of DUGC for one year. As a Convener, I had an important role in ensuring smooth transition from old ARC to new ARC.
    - Member DUGC 2014 - 2015
    - Convener, DUGC 2013 – 2014
    - Member DUGC 2011 - 2013
- Upgraded XRD facility to include 1-D detector, with funds from Institute Plan Grant 2013. XRD analysis software were also procured to help students analyze the XRD data. XRD booking was brought online to make it convenient for the students. These upgradations have ensured that there are no more waiting lists for XRD testing, and the tests can be carried out as and when required
    - Convener, XRD Facility, MSE 2013 – 2015
    - XRD Facility Upgradation at MSE 2013 - 2014
- FIST Proposal 2012 -2014
    - Played an active role in developing the FIST proposal which resulted in getting funds for the department for buying State of the art equipments, viz. FE-SEM, HR-XRD, DMA and nanoindenter (nanoindenter is yet to be procured)
- ACMS rejuvenation: I have been part of ACMS rejuvenation, particularly for complete transformation of electron microscopy lab and upgradation of mechanical testing and sample preparation labs. These labs were completely transformed and several new equipments (W-SEM, FE-SEM, BiSS UTMs, Hardness tester, Charpy tester and Creep test frames) were bought as part of this effort. I have also been instrumental in rejuvenating ACMS website to make all the information about various equipments available online. I have played a major role in making online scheduling system for various equipments which has brought more transparency and democracy in terms of equipment usage at ACMS
    - Convener, Mechanical Testing Lab, ACMS 2014 – Present
    - Convener, Sample preparation Lab, ACMS 2014 – Present
    - Co-Convener, Electron Microscopy Lab, ACMS 2014 – Present
    - Electron Microscopy Lab development at ACMS 2014 - 2015
    - Mechanical Testing Lab Upgradation at ACMS 2014 – 2015
    - ACMS website rejuvenation and scheduling system 2014 – Present

- Electron Microscopy lab (MSE) Upgradation: We were able to get some funding for Electron microscopy facility through Institute Plan Grant-2012 which allowed us to procure EBSD detector for electron microscope and we also procured electropolishing equipment for sample preparation for Orientation Imaging Microscopy (OIM)
- MSE Workshop Upgradation: 2013
    - We were able to get some funds for the MSE workshop through Institute Plan Grant -2013 to procure CNC lathe which allowed sample preparation faster and easier for both teaching and research purposes. We also procured power hacksaw and upgraded existing Shaper machine.
- Member, Institute Website Task Force: 2014 - Present
    - Responsible for upgrading the Institute and department website with inputs from department colleagues. New information had to be created and many more information had to be updated as part of this task.
- Member, Institute Faculty Handbook Committee: 2013 - 2014
    - We created a handbook which can serve as ready reference guide to not only the new joining faculty members, but also for the older members. It provides information and guidelines about various aspects of life of a Faculty member.
- Development of Structural Nanomaterials Lab 2011 – Present
    - Developed Structural Nanomaterials Lab to investigate the effect of thermomechanical processing on microstructure and the mechanical properties of metals and alloys. It includes conventional processes like Lathe machining, sand blasting to non-conventional processes like Constrained Grooved Pressing. Lab hosts all the basic sample preparation facility and some microstructural characterization facilities like Optical Microscope, Hardness tester.
- Department Website Committee: 2013 – Present
    - As a sole member of this committee, I am responsible for making sure that all the contents on the website are updated. With the help of student volunteers, we created a new departmental website, even before the Institute Website Task force took over the task of rejuvenating all the IIT related sites
- Institute Representative for JEE and GATE on several occassions
- CCCC representative: 2012 - 2013
    - As a representative of Computer center coordinating committee, I was able to procure FactSage, a thermodynamic simulation package, for our department
- Seminar Coordinator: 2011 - 2012
    - Organized several seminars during my tenure as seminar coordinator
- Upgradation of Seminar Hall and Lecture room, by getting touch screen and biometric entry system installed
- SURGE Coordinator: 2013-2014 and 2014-2015
    - Served as SURGE coordinator for department for two years

Contributions outside the institute

- Conducted short course on “Structure and Characterization of Materials” at NIT Srinagar July 2015.

- Co-organizer for Automotive Materials and Manufacturing Conference, April 2014, Pune
- Provided consultation to Ordnance Factory, Kanpur on the problems arising in the Russian imported barrels. Several cases had been reported to Field Gun Factory where Russian imported barrels burst open from the two-thirds of the base of the T-72 and T-90 barrels. The discussions involved the Russian counterparts who had provided the parts and our role was to convince them to allow us to conduct some experiments which can help assess the core of the problem in the barrels. We also listed out the methodology of sectioning and listed the experiments which needed to be conducted at Indian side and the Russian side to transparently and fairly examine the problem.
- Provided preliminary analysis to Air-Force on the failure of a cable (2015)
- Associated with RUTAG: Bael cutting machine was developed by students under my mentorship
- Member, Technical Evaluation Committee, Global Conference on Materials Science and Engineering (CMSE 2013)
- Conducted Workshop on "*Principles and Applications of EDS/ EBSD*" at Kalyani Center of Technological Innovation (Bharat Forge Ltd.) (May 2013), Pune
- Talk on "*Advances in Nanostructured Materials Manufacturing and Nanomanufacturing Systems*" at SVNIT, Surat (June 2011). (Organized by Prof. B. Bidanda of University of Pittsburgh on Advances in Manufacturing Systems, as part of IUCEE program)
- Coordinator (along with Prof. S. Sangal and Dr. Partha Ghosal), Metallography Contest, 67th IIM-NMD, IIT (BHU), Varanasi
- Reviewer for *Metallurgical and Materials Transactions – A, Bulletin of Materials Science*, *Journal of Engineering Tribology*, *Journal of Materials Engineering and Performance*, *Current Science*, *Journal of Biomedical Materials Research Part A*, *International Journal of Nanomanufacturing*.
- IIM Kanpur (2011 – Present): Have been actively associated with Indian Institute of Metals, Kanpur Chapter, first as Student Advisor (2011-2012), then as treasurer (2011-2012) and also as Secretary IIM (2012- present). Actively participated in the organization of the flagship event of Batra Quiz since 2011 and several other events.

Others

Published Conference Abstracts

1. B. Sengupta, T. Venkateswaran, S. Shekhar, "*Mechanical behavior of thermomechanically processed duplex steel*," NMD-ATM 2017, Goa.
2. B. Sengupta, S. Shekhar, K. Kulkarni, "*A low cost titanium alloy with excellent compressive strength and hardness*," NMD-ATM2017, Goa.
3. S. Sahu, S. Shekhar, "*Tailoring grain boundary character and triple junction distribution in a Nickel-based superalloy to improve intergranular corrosion resistance*," NMD-ATM2017, Goa.
4. Sanjeev K. Patel, S. Sahu, S. Shekhar, "*Effect of grain boundary engineering on creep properties of Inconel 600 alloy*," NMD-ATM 2017, Goa.
5. P. C. Yadav, S. Shekhar, *"Modulating microstructure of severely deformed Inconel 718 by thermal treatment"* NMD-ATM 2017., Goa.

6. Prabhat K. Rai, S. Shekhar, M. Nakatani, S. K. Vajpai, M. Ota, K. Ameyama, and K. Mondal (2016): "*Corrosion behaviour of SUS304L austenitic stainless steel with harmonic microstructure* (Poster)," NMD-ATM, Kanpur, 11-14 Nov, 2016.
7. Prabhat K. Rai, S. Shekhar, M. Nakatani, S. K. Vajpai, M. Ota, K. Ameyama, and K. Mondal (2017), "*Corrosion and wear behavior of harmonic structured SUS304L austenitic stainless steel* (Poster)," Advanced Materials and Nanotechnology, Osaka, Japan, 26-28 Oct, 2017.
8. Prabhat K. Rai, S. Shekhar and K. Mondal (2017), "A new approach to gradient and harmonic structure design and its effect on electrochemical and tribological behavior," Hetero-2018, Kusatsu, Japan, 30 Oct, 2017.
9. Prabhat K. Rai, S. Shekhar and K. Mondal (2017) "*Development of graded microstructure and its effect on wear behavior of mild steel* (Poster)," ADMAT 2017 SkyMat, Thiruvananthpuram, 14-16 Dec, 2017.
10. B. Sengupta, S. Shekhar, K. Kulkarni, "*A ultrahigh strength Titanium alloy designed with low cost alloying elements*," ICME 2017, IITK.
11. S. Sahu, S. Shekhar, "*Tailoring triple junctions in Inconel 600 alloy to improve intergranular corrosion resistance*," ICME 2017, IITK.
12. P.K. Rai, S. Shekhar, M. Nakatani, S.K. Vajpai, M. Ota, K. Ameyama, K. Mondal, "*Effect of harmonic structure design on the wear behavior of 304L stainless steel*," ICME 2017, IITK.
13. N.K. Sharma, S. Shekhar, "*Scaling behavior of misorientation angle distribution during recrystallization of cold rolled Cu-Zn alloy*," EMSI 2017.
14. P.C. Yadav, S. Shekhar, "*Thermally stable nanostructured Inconel 718 alloy prepared by high rate severe plastic deformation process*," EMSI 2017.
15. S. Sahu, S. Shekhar, "*Effect of deformation temperature and strain on grain boundary engineering of Inconel 600 alloy*," EMSI 2017.
16. P.K. Rai, S. Shekhar, K. Mondal, "*Development of graded microstructure and effect of grain boundary fraction on corrosion behavior of mild steel*," EMSI 2017.
17. S. Sahu, S. Shekhar, "*Effect of Processing Temperature on Grain Boundary Character Distribution of Inconel 600 alloy*," NMD-ATM2016, IITK.
18. P.C. Yadav, S. Shekhar, "*Effect of Pre and Post heat-treatment on microstructural changes of nano-structured Inconel 718 alloy*," NMD-ATM2016, IITK.
19. N.K. Sharma, S. Shekhar, "*Scaling behavior of misorientaiton angle distribution during recrystallization of cold rolled Cu-Zn alloy*," RexGG 2016, CMU.
20. N.K. Sharma, S. Shekhar, "*Evolution of annealing twins during recrystallization and grain growth of cold rolled 316L Stainless Steel*," RexGG 2016, CMU.
21. S. Sahu, P.C. Yadav, S. Shekhar, "*Modification in Grain Boundary Character Distribution in Inconel alloy by Hot Rolling and Annealing*," IAMS 2016, China.
22. P.C. Yadav, S. Sahu, S. Shekhar, "*Effect of Heat treatment on microstructural evolution of machined Inconel 718*," IAMS 2016. China.
23. N.K. Sharma, S. Shekhar, "*Correlation of micro-mechanisms involved during Thermo-mechanical processing with the grain boundary structure of Stainless Steel 316L*", IIM-NMD 2014, Pune
24. S. Sahu, S. Shekhar, "*Effect of Iterative Thermo-mechanical Processing on Grain Boundary Character Distribution of Ni based Supperalloy*", IIM-NMD 2014, Pune

25. A. Sinhal, P.C. Yadav, S. Shekhar, "*Study of Mechanical Properties of Constrained Groove Processed Cu-Zn alloy*", IIM-NMD 2014, Pune
26. M. Verma, S. Shekhar, "*Effect of Machining configurations on mechanical properties of SS316L*", IIM-NMD 2014, Pune
27. N.K. Sharma, S. Shekhar, "*Microstructural Evolution during Cold and Hot Rolling of Stainless Steel 316L*", AM&M 2014, Pune
28. K. Mittal, A. Vaid, Pravin Mungole, K. Kulkarni, S. Shekhar, "*Iterative versus non-iterative Thermomechanical Processing of Inconel-600*," MS&T, Montreal, Quebec, Oct 2013
29. S. Mishra, N. Gurao, S. Shekhar, K. Kulkarni, "*Effect of Texture on Precipitation Kinetics in Aluminum Alloys*," MS&T, Montreal, Quebec, Oct 2013
30. N.K. Sharma, S. Shekhar, "*Correlation of micro-mechanisms involved during Thermo-mechanical processing with the grain boundary structure of Stainless Steel 316L*" IUCR 2013, China.
31. S. Sahu, S. Shekhar, "*Modifications in the Grain Boundary Character Distribution of Inconel 600 alloy by Thermomechanical Processing*", International Conference on Metallurgical& Materials Processes, Products and Applications (ICMMPPA) 2014, OPJIT Chhattisgarh.
32. A. Vaid, Praveen Mungole, S. Shekhar, "*Grain Boundary Engineered Inconel alloy for Improved Corrosion-resistance*," NRB, Chennai, Feb. 2013
33. I. Binkowski, H. Edelhoff, J. Leuthold, M. Wegner, G. Reglitz, M. Peterlechner, S. Shekhar, A. King, S. Divinski, G. Wilde, "*Kinetic Processes in copper bi- and tricrystals",* German Research Foundation 2012.
34. G. Facco, S. Shekhar, M. R. Shankar, A. K. Kulovits and J.M.K. Wiezorek, "*Surface modification of 316L stainless steel by a low temperature severe plastic deformation linear raking process*," MRS Fall-2010.
35. S. Abolghasem, S. Basu, S. Shekhar and M.R. Shankar, "*Surface Engineering using Modulated Machining*," IERC 2010.
36. S. Shekhar, J. Cai and M.R. Shankar, "*Machining as a Route to Obtain Multi-functional Materials*," IERC 2010.
37. S. Shekhar, J. Cai, and M.R. Shankar, "*Engineering Stored Energy in Fine Grained Metals from Severe Plastic Deformation*," TMS Annual Meeting, Seattle, WA, Mar. 2010
38. M.R. Shankar, S. Shekhar and J. Cai, "*Ideal Engineering Materials by High Rate Severe Plastic Deformation*," TMS 2010, Seattle, WA.
39. S. Shekhar, J. Cai, and M.R. Shankar, "*Novel Nanostructured Metals by High Rate Severe Plastic Deformation*," MRS Fall-2009.
40. S. Shekhar, Alexander H. King, "*Read-Shockley Grain Boundaries and the Herring Equation*," MRS Spring-2008 Meetings, San Francisco, CA. (poster presentation)
41. S. Shekhar, H. Kim, R. Narayanan and A.H. King, "*Triple Junction Property Assessments*," IIB 2007, International conference on Intergranular and Interphase Boundaries in Materials, Barcelona, Spain.
42. S. Shekhar, Alexander H. King, "*Stability of Triple Junctions*," GRC-2007, NH. (poster presentation)
43. Alexander H. King, Mysore A. Dayananda, Raghavan Narayanan, S. Shekhar, "*Rapid Diffusion in Grain Boundary Triple Junctions*", 2006 TMS Annual Meeting and Exhibition, San Antonio, CA.

44. S. Shekhar, Alexander H. King, "*Growth and Stability of Grain Boundary Triple Junctions in Copper*," MRS Fall-2005 Meetings, Boston, MA.

- Gave a talk at TEQIP on course curriculum of Materials Science. It was attended by several faculty members of NITs and other regional colleges. I introduced them to the several websites and resources which are available for Materials Scientists. I also talked about my experience in helping improve the learning ability of the students, particularly in large classes (~80 students).
- Development of Research Lab at University of University of Pittsburgh: Played an important role in development and set up or Research Lab for Prof. Ravi Shankar during my post-doctoral fellowship. Prof. Ravi Shankar had joined the University just a little more than a year ago, before I joined his group and contributed heavily to set up his lab which works mainly on understanding the behavior of materials over length – scales ranging from micro to nano.