

CHETAN SINGH

Assistant Professor

Department of Metallurgical and Materials Engineering
Indian Institute of Technology Kharagpur

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[Google Scholar](#) [in LinkedIn](#) [ResearchGate](#) [ORCID](#)

Research Interests

Long-term goal: Advance the design and understanding of metallic materials by bridging synthesis, processing, microstructural evolution, and performance across multiple length scales.

My independent research program at IIT Kharagpur pursues two interconnected thrusts: (1) **reactive and energetic metallic systems** — designing ultrasonically atomized Al- and Mg-based alloy powders with tunable ignition, combustion, and reactivity through mechanism-driven microstructural control; and (2) **lightweight structural alloys** — developing biodegradable Mg–Ca–Sc alloys for biomedical implants and engineering thermomechanical processing routes to optimize deformation, texture, and corrosion behavior in Mg and Al alloy systems. Underpinning both thrusts is a commitment to advanced electron microscopy and in-situ/ex-situ characterization as tools to establish quantitative structure–property–performance relationships.

Key areas: Lightweight Metallic Materials (Mg and Al Alloys); Reactive and Energetic Metal Powders; Mechanism-Based Alloy Design; Thermomechanical Processing; Advanced Electron Microscopy; Structure–Property Relationships.

Professional Positions

Indian Institute of Technology Kharagpur, India 2026–Present
Assistant Professor, Department of Metallurgical and Materials Engineering

Johns Hopkins University, USA 2026–Present
Whiting Fellow (Visiting/Honorary), Hopkins Extreme Materials Institute
Visiting/honorary fellowship with no monetary commitment or obligation to visit; maintains research affiliation with the Hopkins Extreme Materials Institute.

Johns Hopkins University, USA 2024–2026
Assistant Research Scientist, Hopkins Extreme Materials Institute

Chungnam National University, Republic of Korea 2023–2024
Postdoctoral Researcher, Department of Materials Science and Engineering

Indian Institute of Technology Delhi, India 2022–2023
IRD Early-Doc Fellow / Project Staff, Department of Materials Science and Engineering

Education

Indian Institute of Technology Delhi, India 2018–2022
Doctor of Philosophy (Ph.D.), Materials Science and Engineering

Advisor: [Prof. Jayant Jain](#)

Thesis: Development of novel Mg–Ca–Sc alloys as potential biodegradable implant material (funded through the Prime Minister’s Research Fellowship (PMRF))

Thesis Committee: [Prof. Jayant Jain](#), [Prof. Rajesh Prasad](#), [Prof. Suresh Neelakantan](#), [Prof. Deepak Kumar](#)

Indian Institute of Technology Roorkee, India 2014–2018
Bachelor of Technology (B.Tech), Metallurgical and Materials Engineering

Advisor: [Prof. Gajanan P. Chaudhari](#)

Thesis: Nanofluid spray cooling for heat-transfer enhancement of high-temperature steel surface and its effect on microstructural properties

Publications

Self | [†] Co-first author | *Italicised:* Journal | **Purple:** Chetan’s mentees | [Google Scholar](#) |

Journal Articles

J20. A. Gokhale, B. Harun, **C. Singh**, T.P. Weihs, J. Jain, A.K. Das, A.D. Varma, [Failure Investigation of Intrados and Neutral Axis Cracking in TP347H Reheater Bend Tubes of an 800 MW Power Plant](#), *Journal of Failure Analysis and Prevention*, 2026.

- J19. R. Berlia, **C. Singh**, Z. Qu, R. Mehta, T.P. Weihs, [Revealing Bulk-like Properties in Freestanding PVD Copper Foils](#), *Materials Science and Engineering: A*, 2025.
- J18. A. Gokhale, S. Mangam, **C. Singh**, J. Jain, A.K. Das, A.D. Varma, [Hydrogen Damage in Carbon Steel Tubing: An Investigation of Various Macro-Failure Morphologies Observed in Boiler Water Wall Tubes Manifesting as Hydrogen Damage Failure](#), *Journal of Failure Analysis and Prevention*, 2024.
- J17. **N.T. Dung**, **C. Singh**, T. Lee, K.H. Lee, D.H. Lee, S.Y. Lee, [Hydrogen-driven ultra-cryogenic deformation and embrittlement in Ti6Al4V alloy at 15 K](#), *Materials Science and Engineering: A*, 2024.
- J16. **C. Singh**, **T. Lee**, K. Lee, Y.S. Kim, E. Hunag, J. Jain, P.K. Liaw, S. Y. Lee, [Exceptional Fatigue resistant Austenitic Stainless Steel for Cryogenic Applications](#), *Applied Materials Today*, 2024.
- J15. **T. Lee**, **C. Singh**, S.V. Sujith, Y.S. Kim, J.Y. Kang, S.Y. Lee, [Rate-dependent serration behavior of high manganese steel at ultra-low temperature](#), *Journal of Materials Science and Technology*, 2024.
- J14. K.R. Ramkumar, S. Vigneshwaran, **C. Singh**, R.E. Kim, P. Seenuvasaperumal, and H.S. Kim, [Effect of cryo-rolling on strengthening–softening transition in deformation twinned Cupronickel \(Cu-10Ni\) alloy](#), *Metallurgical and Materials Transactions A*, 2024.
- J13. **T.D. Nguyen**, **C. Singh**, Y.S. Kim, J.H. Han, D.H. Lee, K. Lee, S. Harjo, and S.Y. Lee, [Mechanical properties of base metal and heat-affected zone in friction-stir-welded AA6061-T6 at ultra-low temperature of 20 K](#), *Journal of Materials Research and Technology*, 2024.
- J12. **T.D. Nguyen**, **C. Singh**, D.H. Lee, Y.S. Kim, T. Lee, and S.Y. Lee, [Deciphering Hydrogen Embrittlement Mechanisms in Ti6Al4V Alloy: Role of Solute Hydrogen and Hydride Phase](#), *Materials*, 2024.
- J11. A. Hussain, S. Khan, S. Sharma, S. Sharma, **C. Singh**, A. Rastogi, P.K. Kulriya, [Swift Au+9 ion irradiation-induced defects and alloy complexity effect on the mechanical hardness of NiCoCrFePd HEA and NiCoCrFe MEA](#), *Journal of Applied Physics*, 2024.
- J10. **C. Singh**, S.S. Singh, J. Jain, [Development of sustainable novel Mg-Ca-Sc alloys with exceptional corrosion resistance](#), *Journal of Alloys and Compounds*, 2023.
- J9. A. Gokhale, M. Subhakar, **C. Singh**, P. Halder, A. Kumar Das, J. Jain, A. D. Varma, [Failure investigation of brazed copper winding bar strands of 250 MW stator](#), *Engineering Failure Analysis*, 2023.
- J8. **C. Singh**, K. Hariharan, S.P. Phani, F.C. Chen, D.P. Tran, C. Chen, J. Jain, [Influence of additives induced microstructural parameters on mechanical behavior of \(111\)-oriented nanotwinned microcrystalline copper](#), *Materials Science and Engineering: A*, 2023.
- J7. A. Kumar, B. Jayabalan, **C. Singh**, J. Jain, S. Mukherjee, K. Biswas, S.S. Singh, [Role of chromium content on the microstructure and mechanical properties of lanthana based ferritic ODS steels](#), *Metals and Materials International*, 2022.
- J6. A. Hussain, S.A. Khan, S.K. Sharma, K. Sudarshan, S.K. Sharma, **C. Singh**, P.K. Kulriya, [Influence of defect dynamics on the nanoindentation hardness in NiCoCrFePd high entropy alloy under high dose Xe+3 irradiation](#), *Materials Science and Engineering: A*, 2023.
- J5. **C. Singh**, S.S. Singh, J. Jain, [Elucidating the role of micro-galvanic coupling between eutectic \$\alpha\$ -Mg lamellas and \$\alpha\$ -Mg matrix on the hydrogen evolution behaviour of Mg-0.6 Ca binary alloy using real-time imaging](#), *Philosophical Magazine Letters*, 2022.
- J4. **C. Singh**, S.S. Singh, J. Jain, [Elucidating the role of grain boundary sliding in enhanced ductility of high strain rate sensitive Mg-Ca binary alloy: an in-situ study](#), *Materials Science and Engineering: A*, 2022.
- J3. A. Gokhale, A. Varma, **C. Singh**, J. Jain, R.K. Yadavalli, [Failure analysis of SS 304 HCu reheater tube of a supercritical power plant](#), *Engineering Failure Analysis*, 2022.
- J2. A. Kumar, B. Jayabalan, **C. Singh**, J. Jain, S. Mukherjee, K. Biswas, S.S. Singh, [Processing and properties of yttria and lanthana dispersed ODS duplex stainless steels](#), *Materials Science and Engineering: A*, 2022.
- J1. **C. Singh**, L. Narayan, J. Jain, [Influence of simultaneous alloying with Ca and Sc on the high temperature deformation mechanism, texture, and recrystallization behavior of Mg-Ca-Sc alloys](#), *Materials Characterization*, 2021.

Preprints

- P1. **C. Singh**, **A. Goglia**, P. Mastracco, M. Flickinger, L.J. Kecskes, P. Clancy, T.P. Weihs, [Synthesis and Characterization of Ultrasonically Atomized Al-Based Alloy Powders for Tunable Thermal Reactivity](#), *arXiv preprint*, 2025.

Under Review

- UR2. N.J. Lies, **C. Singh**, D. Driemeyer, T.P. Weihs, A.P. Stebner, Unmasking the “Rhenium Softening Effect” in Dilute Molybdenum-Rhenium Alloys, *Scripta Materialia*, 2026.
- UR1. L. Yang†, **C. Singh**†, W. Dam, Y. Zhou, T.P. Weihs, M.R. Zachariah, In-operando high-speed holography and pyrometry of composition-controlled micro-explosions and agglomerate breakup in Al-Mg energetic fuels, 2026.

In Preparation

- IP5. S. Raguraman, **C. Singh**, B.Z. Plunhoff, R.J. Guillory II, M.L. Jammeh, A. Griebel, J.F. Löffler, A. Kopp, T.P. Weihs, Bridging Discovery and Deployment in Biodegradable Magnesium Implants: A Translational Roadmap for Research, Manufacturing, and Clinical Adoption, *Nature Biomedical Engineering* (**proposal submitted**).
- IP4. **C. Singh**, W. Murphy, I. Queen, **H.D. Almeida**, M. Flickinger, T.P. Weihs, Effect of Mg Concentration and Manufacturing Pathway on the Reactivity of Al-Mg Alloy Powders.
- IP3. **C. Singh**, **A. Goglia**, M. Flickinger, L.J. Kecskes, T.P. Weihs, Designed to Ignite: Microstructural Tuning of Al-Alloy Powders via Post Processing.
- IP2. **C. Singh**, R. Berlia, T.P. Weihs, Mechanistic Insights into Marangoni-Driven Core-Shell Microstructures in Ultrasonically Atomized Al-Bi-X Powders.
- IP1. **C. Singh**†, T.D. Nguyen†, T. Lee, S.Y. Lee, Extraordinary fatigue-resistance AA6061 aluminum alloy for ultracryogenic temperature applications, *Journal of Alloys and Compounds*.

Conference Presentations

- C17. **C. Singh** et al., From Implants to Ignition: Magnesium Alloy Design Across Biomedical and Energetic Applications, Combustion Products, and LASEM Response, *Magnesium Technology 2027, TMS Annual Meeting & Exhibition*, 2027. (*Invited Presentation; Accepted, Upcoming*)
- C16. **C. Singh**, W. Murphy, E. Wainwright, and T.P. Weihs, Alloying Aluminum Powders for Tunable Reactivity: Binary and Ternary Alloy Microstructures, Combustion Products, and LASEM Response, *Materials Science in Extreme Environment URA, ATR*, 2026. (Best Presentation Award)
- C15. **C. Singh**, **H.D. Almeida**, and T.P. Weihs, Integrating Alloying and Processing to Tailor Ignition and Combustion in Reactive Aluminum Alloy Powders, *Gordon Research Conference*, 2026.
- C14. **C. Singh**, **H.D. Almeida**, and T.P. Weihs, Integrating Alloying and Processing to Tailor Ignition and Combustion in Reactive Aluminum Alloy Powders, *Gordon Research Seminar*, 2026.
- C13. **C. Singh**, **A. Goglia**, P. Mastracco, M. Flickinger, L.J. Kecskes, P. Clancy, T.P. Weihs, [Synthesis and Characterization of Ultrasonically Atomized Al-Based Alloy Powders for Tunable Thermal Reactivity](#), *TMS Annual Meeting & Exhibition*, 2026.
- C12. **C. Singh**, **A. Goglia**, M. Flickinger, L. Kecskes, and T.P. Weihs, Designed to Ignite: Microstructural Tuning of Al-Alloy Powders, *Materials Science in Extreme Environment URA Student Symposium, Pacific Northwest National Lab*, 2025.
- C11. **C. Singh**, **A. Goglia**, B. McGrann, G.M. Gonzalez, M. Flickinger, L. Kecskes, and T.P. Weihs, Synthesis and Characterization of Reactive Aluminum-Based Alloy Powders for Advanced Applications, *Gordon Research Conference*, 2025.
- C10. **C. Singh**, **A. Goglia**, B. McGrann, G.M. Gonzalez, M. Flickinger, L. Kecskes, and T.P. Weihs, Synthesis and Characterization of Reactive Aluminum-Based Alloy Powders for Advanced Applications, *Gordon Research Seminar*, 2025.
- C9. **C. Singh**, M. Flickinger, L. Kecskes, and T.P. Weihs, Reactive by Design: Alloying and Etching Strategies for Tunable Al Powders, *Weapons of Mass Destruction, ATR*, 2025. (*Invited Presentation*)
- C8. **T. Lee**, S.Y. Lee, **C. Singh**, Y. Kim, J. Kang, J. Han, D.H. Lee, Rate-dependent serration flow and mechanical properties of high manganese steel at 15 K, *TMS Annual Meeting & Exhibition*, 2025.
- C7. **T.D. Nguyen**, Y.S. Kim, **C. Singh**, S. Harjo, S.Y. Lee, In-situ neutron diffraction study of ultra-low temperature mechanical properties of base metal and heat-affected zone in friction stir welded AA6061 alloy, *HANARO Symposium*, 2024.
- C6. **T.D. Nguyen**, Y.S. Kim, **C. Singh**, S. Harjo, S.Y. Lee, Investigation of mechanical properties of friction-stir-welded AA6061 alloy at 20 K, *Korean Institute of Metals and Materials, Fall Conference*, 2024.

- C5. **T.D. Nguyen, C. Singh**, Y.S. Kim, S. Harjo, S.Y. Lee, Ultra-low temperature mechanical behavior of base metal and heat-affected zone in friction-stir-welded AA6061-T6, *Spring Conference of the Korean Society for Heat Treatment*, 2024.
- C4. **T. Lee, C. Singh**, D.H. Lee, J.Y. Kang, S.Y. Lee, Evaluation of 15 K serration behavior and tensile properties of high manganese steel depending on strain rate, *The Korea Institute of Metals and Materials*, 2024.
- C3. **C. Singh**, Y. S. Kim, S. Y. Lee, Investigation of tensile and fatigue properties of 316L stainless steel at 20K, *Pacific Rim International Conference on Advance Materials and Processing (PRICM)*, 2023.
- C2. **C. Singh**, J. Jain, Influence of Ca and Sc addition on the deformation mechanism, recrystallization, and texture of hot-rolled binary and ternary Mg-alloy, *3rd Indian Materials Conclave (IndMac) and 32nd Annual General Meeting of MRSI*, 2021.
- C1. **C. Singh**, J. Jain, Mg-Ca-Sc alloys: Potential orthopaedic biodegradable load-bearing implants material, *Prime Minister Research Fellowship (PMRF) symposium*, 2021.

Patent

- P1. J. Jain, N.N. Gosvami, A. Bhowmik, **C. Singh**, I. Agarwal, A Method for Electroplating an Alloy and Composition Thereof, 202411013979, 2024.

Funded Fellowships and Awarded Research Proposals

Prime Minister's Research Fellowship (PMRF) 2018–2023

Ministry of Education, Government of India

Role: Principal Applicant (Sole Author of Proposal)

Total Funding: INR 5,500,000 (USD 66,000)

Independently authored a successful proposal to the nationally competitive PMRF program (awarded to fewer than 1 % of applicants nationwide). The fellowship provided full support for my doctoral research on bioabsorbable alloys, including a stipend and annual contingency funding for research expenses providing nearly twice the standard doctoral stipend in India, underscoring the program's selectivity and national prestige.

Unearthing the Effect of Deep Cryogenic and Room Temperature Pre-Straining on Low- Feb 2025

Cycle Fatigue of AA6061 Alloy

Oak Ridge National Laboratory, USA

Advisor: Prof. Soo Yeol Lee (PI; institutional requirement)

Type: Awarded Beamtime | **Role:** Conceived study, authored proposal, and led in-person experiments at ORNL as postdoctoral researcher

Elucidating the Influence of Heterogeneous Microstructures Engineered via Pre-Straining Sep 2024

During Deep Cryogenic Treatment at 15 K

Oak Ridge National Laboratory, USA

Advisor: Prof. Soo Yeol Lee (PI; institutional requirement)

Type: Awarded Beamtime | **Role:** Conceived study, authored proposal, and led in-person experiments at ORNL as postdoctoral researcher

Exploring the Correlation Between Precipitation Behavior and Lattice Strain Evolution Sep 2025

in AA6061 Alloy

Oak Ridge National Laboratory, USA

Advisor: Prof. Soo Yeol Lee (PI; institutional requirement)

Type: Awarded Beamtime | **Role:** Conceived study, authored proposal, and led in-person experiments at ORNL as postdoctoral researcher

Additional Grant Writing Experience: Contributing to the development of grant proposals to NIH, and NSF focused on advanced structural biomaterials and bioabsorbable metal systems.

Leadership and Professional Service

The Minerals, Metals & Materials Society (TMS) Member, 2024–Present

- Symposium Co-Chair, *Characterization of Minerals, Metals and Materials 2026* Poster Session, TMS 2026 Annual Meeting & Exhibition
- Session Chair, *Advanced Characterization IV: Electron Microscopy-Based Techniques II*, TMS 2026 Annual Meeting & Exhibition

- Member, Magnesium Technical Committee
- Member, Aluminum Committee
- Reviewer, *JOM: The Journal of The Minerals, Metals & Materials Society*
- Presenter, TMS Annual Meeting & Exhibition (2025, 2026)

International Magnesium Association (IMA)

Member, 2024–Present

Mentorship: AEOP High School Apprenticeship Program

2025

Hopkins Extreme Materials Institute, Johns Hopkins University

Mentored high school students in hands-on research through the Army Educational Outreach Program (AEOP). Recognized with a \$1,500 award for mentorship excellence.

Peer Reviewer

- *Acta Materialia*
- *Journal of Alloys and Compounds*
- *Materials Science & Engineering A*
- *Materials Characterization*
- *JOM: The Journal of The Minerals, Metals & Materials Society*

Professional Outreach and Engagement**From Implants to Ignition: Microstructure as a Compass**

2026

Materials Graduate Society, Johns Hopkins University, USA. (Invited)

Invited career-development seminar for graduate students highlighting my research trajectory across biodegradable implants, cryogenic mechanical testing, and reactive metal powders, with selected microstructure case studies and lessons from key career pivots.

Workshop Organizer: Stepping into the World of Research

2022

Hindu College, University of Delhi, India.

Organized and delivered a two-day workshop on literature review and research methodology; covered research question development, literature search/synthesis, and methodology design.

Advising & Mentorship**co-authors on publications***Ph.D. Students**

Thanh-Dat Nguyen*	Ph.D. in Materials Science and Engineering Chungnam National University, Republic of Korea	2023–2024
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Taeho Lee*	Ph.D. in Materials Science and Engineering Chungnam National University, Republic of Korea	2023–2024
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Tien-Dung Nguyen*	Ph.D. in Materials Science and Engineering Chungnam National University, Republic of Korea	2023–2024
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Undergraduate Students

Ava Goglia*	B.S. in Chemical and Biological Engineering Johns Hopkins University, USA	2025–2026
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Max Gao	B.S. in Electrical Engineering Johns Hopkins University, USA	2025–2026
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Helena De Almeida*	B.S. in Mechanical Engineering Johns Hopkins University, USA	2025–2026
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William Tun	B.S. in Mechanical Engineering Johns Hopkins University, USA	2025–2026
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Brennan McGrann	B.S. in Chemical and Biological Engineering Johns Hopkins University, USA	2025
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Grecia Munoz Gonzalez

B.S. in Chemical and Biological Engineering
Johns Hopkins University, USA

2025

High School Student

Ekansh Dave

High School Student
Poolesville High School, USA

2025

Research Projects

R7. Ultrasonic Atomization of Metal Powders for Energetic Applications*Johns Hopkins University, USA*Advisor: [Prof. Timothy P. Weihs](#)Collaborators: [Prof. Michael R. Zachariah](#)(University of California, Riverside), [Dr. Elliot R. Wainwright](#) (Army Research Lab), [Prof. Paulette Clancy](#)(Johns Hopkins University)

Lead the design, synthesis, and microstructural optimization of ultrasonically atomized reactive metal alloy powders to tailor ignition and combustion behavior; investigating microstructure-driven design strategies for bioabsorbable magnesium alloys.

R6. Investigation of Mechanical Behavior of Metallic Materials under Static and Dynamic Loading at Cryogenic Temperatures (15 K)*Chungnam National University, Republic of Korea*Advisor: [Prof. Soo Yeol Lee](#)

Investigated fatigue behavior of metallic materials at 15 K using advanced characterization techniques; developed and established thermomechanical processing routes to enhance toughness through microstructural design; established correlative frameworks linking processing, microstructure, and lattice strain evolution in SS316L and high-Mn steels.

R5. Development of Mg–Ca–Sc Alloys for Biodegradable Implants (Doctoral Thesis)*Indian Institute of Technology Delhi, India*Advisor: [Prof. Jayant Jain](#)Collaborators: [Prof. Sudhanshu S. Singh](#)(Indian Institute of Technology Kanpur)Constructed a pseudo-binary Mg–Ca–Sc phase diagram and optimized thermomechanical processing parameters; performed in-situ mechanical testing with ex-situ AFM to study strain rate effects; developed Mg–0.6Ca–0.5Sc alloy with corrosion rate $\approx 90\%$ lower than AZ31.**R4. Microstructure Optimization of Textured Nano-Twinned Copper for Electronic Packaging***Indian Institute of Technology Delhi, India*Advisor: [Prof. Jayant Jain](#)Collaborators: [Prof. Chih Chen](#)(National Chiao Tung University, Taiwan), [Prof. K. Hariharan](#) (Indian Institute of Technology Madras), [Prof. S.P. Pardhasaradhi](#)(International Advanced Research Centre for Powder Metallurgy and New Materials)

Studied temperature-dependent nanomechanical response using nanoindentation; developed an effective length-scale parameter combining grain size and twin spacing to explain strength and strain rate sensitivity of nt–mc–Cu.

R3. Developed a Superior and Sustainable Rose Gold Plating on Sterling Silver (Industry Collaboration)*Indian Institute of Technology Delhi, India*Advisor: [Prof. Jayant Jain](#)Collaborators: [Prof. Nitya Nand Goswami](#)(Indian Institute of Technology Delhi), [Dr. Ayan Bhowmik](#)(Indian Institute of Technology Delhi), [Indiejewel Fashions Pvt. Ltd. \(GIVA\)](#)Developed an eco-friendly rose gold plating process by optimizing base metal composition and processing parameters; achieved $\approx 500\%$ increase in coating life. (Patent filed: 202411013979).**R2. Failure Analysis and Redesign of Pressure Switches (Industry Collaboration)***Indian Institute of Technology Delhi, India*Advisors: [Prof. Jayant Jain](#), [Prof. Suresh Neelakantan](#), [Prof. Nitya Nand Goswami](#)Collaborator: [WIKI \(Germany\)](#)

Identified root causes of catastrophic failure in 20 A switches through systematic analysis; proposed material and processing improvements; co-developed a 60 A switch with integrated starter arrangement.

R1. Nanofluid Spray for Heat-transfer Enhancement for Steel Industry (Undergraduate Thesis)*Indian Institute of Technology Roorkee, India*Advisor: [Prof. Gajanan P. Chaudhari](#)

Collaborators: Kanika Agarwal

Investigated the effect of Al_2O_3 nanoparticle concentration on spray cooling performance and colloidal stability; studied the influence on surface hardness and microstructure of high-temperature steel.

Ongoing Research Collaborations

Prof. Paulette Clancy	Professor / AI-X Foundry	Johns Hopkins University, USA
Prof. Michael R. Zachariah	Professor	University of California, Riverside, USA
Dr. Aditya Gokhale	Manager	JSW Steel Ltd. Vijayanagar Works, India
Dr. Peter Mastracco	Postdoctoral Fellow	Johns Hopkins University, USA
Dr. Elliot R. Wainwright	Research Scientist	Army Research Laboratory, USA
Dr. Nathan J. Lie	Research Assistant	Georgia Institute of Technology, USA
Prof. Soo Yeol Lee	Professor	Chungnam National University, Republic of Korea

Teaching Experience

- T4. Phase Transformation and Heat Treatment of Materials** July–Dec 2026
Instructors: Prof. Chetan Singh and Prof. Shiv Brat Singh, Indian Institute of Technology Kharagpur, India
 Co-developed and co-instructing a core undergraduate course on phase transformations and heat treatment. Developed lecture content, tutorials, and assessment materials while introducing case-based discussions linking phase transformations to industrial alloy processing and design.
- T3. Heat Treatment of Materials Laboratory** July–Dec 2026
Instructors: Prof. Chetan Singh and Prof. Sujoy Kumar Kar, Indian Institute of Technology Kharagpur, India
 Co-instructing an undergraduate laboratory course on heat treatment and phase transformations. Contributed to redesigning laboratory experiments, developing instructional material, and integrating microstructural characterization with processing–structure–property relationships.
- T2. Case Studies in Metallurgical and Materials Engineering** July–Dec 2026
Instructors: Prof. Chetan Singh, Prof. Koundiniya NTBN, Prof. Koushik Biswas, and Prof. Manish Kumar Kar, Indian Institute of Technology Kharagpur, India
 Co-developed and co-instructing a case-based undergraduate course emphasizing failure analysis, alloy design, manufacturing, characterization, and industrial problem solving through real-world materials engineering case studies.
- T1. Introduction to Materials Science and Engineering** 2018–2022 (7 semesters)
Various Instructors, Indian Institute of Technology Delhi, India
 Served as Head Teaching Assistant across seven consecutive semesters. Designed and conducted weekly tutorial and laboratory sessions covering crystal structures, phase transformations, and mechanical behavior. Developed and graded problem sets, prepared solution manuals, and recorded video lectures. Also assisted with foundational engineering sessions for first-year students (Introduction to Engineering and Program, 2020).

Skills and Expertise

Fabrication:	Ultrasonic atomization; Arc melting; Casting.
Characterization:	Scanning Electron Microscopy (EBSD, ECCI, EDS, in-situ heating); Focused Ion Beam (FIB); Transmission Electron Microscopy (sample preparation and analysis); X-ray Diffraction (XRD); Atomic Force Microscopy (AFM); Optical Profilometry; Particle Size Analyzer.
Mechanical & Functional Testing:	Wire Ignition; Differential Thermal Analyzer (DTA); Mechanical testing (nanoin-dentation, tension, compression, fatigue, microhardness) under extreme environment (15 K), Corrosion Testing (immersion, hydrogen evolution, electrochemical testing, including potentiodynamic polarization, pH variation).
Computational Tools:	Python; MATLAB (MTEX); TSL-OIM; HKL Channel 5; Thermo-Calc; OriginLab; ImageJ.
Laboratory Techniques:	Ion milling; Electropolishing; Electroetching; Metallographic sample preparation; Machining.

Awards and Recognitions

Best Presentation Award, recognized by the Acting Director of the U.S. Defense Threat Reduction Agency (DTRA), Maj. Gen. Lyle K. Drew, for outstanding research on reactive metal powders presented at the *Materials Science in Extreme Environments URA, ATR* meeting; also received the *Director's Challenge Coin* in recognition of the contribution, 2026.

Second Prize: Electron Microscopy Image Contest, *Materials Characterization and Processing Facility, Johns Hopkins University*, 2025.

American Society of Metals (ASM International): Acknowledged advanced microscopy skills and featured SEM work in *Microstructure–MicroArt*, published in *Metallography, Microstructure, and Analysis (MMA)*, 2023.

Invited Workshop Speaker: Delivered a research workshop at Hindu College, University of Delhi on "*Stepping into the World of Research: Literature Review & Research Methodology*," 2022.

JEOL USA: Recognized for advanced microscopy skills and publication of "*Heart of Magnesium*" micrograph in their annual microscopy issue, 2021.

Prime Minister's Research Fellowship (PMRF): Awarded by the Ministry of Human Resource and Development, Government of India, for pursuing Ph.D. directly after B.Tech (top 0.7% of research scholars selected nationally), 2018-2023.

Merit-cum-Means Scholarship: Awarded a scholarship of 100,000 by IIT Roorkee to pursue a Bachelor of Technology (B.Tech), 2015.

National Rank (JEE–Advanced): Among the top 0.5% of candidates (AIR 5463) out of approximately 1.2 million applicants, 2014.

References

Timothy P. Weihs, Professor & Program Director, MSEE-URA
Department of Materials Science and Engineering
Johns Hopkins University, USA
Relationship: Postdoctoral Advisor | **Email:** weihs@jhu.edu

Jayant Jain, Professor & Head of Department
Department of Materials Science and Engineering
Indian Institute of Technology Delhi, India
Relationship: Ph.D. Advisor | **Email:** jayant.jain@mse.iitd.ac.in

Dr. Aditya Gokhale, Manager
Research & Development and Scientific Services
JSW Steel Limited, Vijayanagar Works, Karnataka, India
Relationship: Research Collaborator | **Email:** aditya.gokhale@jsw.in