Pranjal Nautiyal

Curriculum Vitae

Assistant Professor
School of Mechanical and Aerospace Engineering
College of Engineering, Architecture and Technology
Oklahoma State University

Executive Summary

Dr. Pranjal Nautiyal is an Assistant Professor in the School of Mechanical and Aerospace Engineering at Oklahoma State University (OSU), Stillwater, Oklahoma. He obtained his Ph.D. in Materials Science and Engineering (2020) from Florida International University and completed his postdoctoral training at the University of Pennsylvania (2020-23), before starting in his current position in 2023.

Research: Dr. Nautiyal's research expertise is in advanced materials processing and experimental mechanics. The current foci of his research group are nanomanufacturing, metal additive manufacturing, nanotribology, and mechanochemistry. Since joining OSU in 2023, he has been instrumental in securing over $1.1M in research funding from the NSF, NASA, USDA, and ACS. He has published 48 peer-reviewed journal articles, including papers in influential journals in his field such as *Science Advances*, *Nano Letters*, *Small*, *Acta Materialia*, *Scripta Materialia*, and *Carbon*. He has co-authored 1 book and 1 book chapter. He is also an inventor of 7 US patents and 1 invention disclosure. He has delivered over 40 presentations at international, national, and regional conferences, workshops, and webinars, including 6 invited lectures.

Teaching and Mentorship: Dr. Nautiyal currently mentors 2 doctoral, 2 masters, and 1 undergraduate researcher in his group, and serves in the dissertation committees of 5 graduate students at OSU. His mentees have been recognized with awards from professional societies for their research presentations at conferences. His teaching interests include materials, manufacturing, and design. He has taught 2 undergraduate courses and developed and taught 1 new graduate course at OSU. He also served as a faculty mentor for a senior design team.

Service: Dr. Nautiyal is an active member of the Society of Tribologists and Lubrication Engineers (STLE) and The Minerals, Metals and Materials Society (TMS), where he has served on multiple committees, notably the Nanotribology Technical Committee (STLE), the Early Career Awards Committee (STLE) and the Emerging Professionals Committee (TMS). He has co-organized 6 symposia focused on nanotribology and in-situ materials characterization and chaired multiple sessions in the STLE and TMS annual meetings. He has served as a reviewer for more than 20 journals in the areas of materials science and engineering, nanotechnology, and tribology, and has served as a technical proposal reviewer for the National Science Foundation, the French National Research Agency, and the American Chemical Society. At OSU, Dr. Nautiyal serves as a faculty co-advisor of the American Society of Mechanical Engineers (ASME) student chapter in MAE, has been a faculty evaluator for MAE senior design projects since 2023, has served as a faculty interviewer for the CEAT Scholars Program since 2023, and has mentored students in the CEAT Summer Bridge Program in 2024.

Honors and Awards: Dr. Nautiyal has been recognized by the Early Career Researcher Award by the STLE (2023) for excellence in research, the Nanomaterials and Energy Prize by the Institute of Civil Engineers (2020) for an impactful journal article, the TechConnect Defense Innovation Award (2018) for a technology submission, the Graduate Excellence in Materials Science Award (2018) by the American Ceramic Society for scientific achievements in materials science and engineering as well as a Best Paper Award (2019) and a Best Poster Award (2018) by the TMS. He was named a Senior Member of the National Academy of Inventors in 2023.

Pranjal Nautiyal, PhD

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Lab Website: https://ceat.okstate.edu/mae/research/extreme-interfaces/

RESEARCH INTERESTS

- **Advanced Materials Processing**: Cold spray additive manufacturing, Nanomanufacturing, Nanocomposites
- **Interfacial Mechanics and Tribology**: In-situ studies of deformation, friction, wear, and lubrication
- **Mechanochemistry**: Stress-induced reactions of ionic liquid lubricants, Mechanocatalysis on high entropy alloys

RESEARCH OUTPUT

Journal Articles: 48 | **Patents**: 7 | **Book:** 1 | **Book Chapter:** 1 | **Full List:** GoogleScholar

ACADEMIC APPOINTMENTS

- **Assistant Professor** (tenure track) in **School of Mechanical and Aerospace Engineering**
  Oklahoma State University, Stillwater, USA (July 2023 – Present)

EDUCATION & TRAINING

- **Postdoctoral Researcher** in **Mechanical Engineering and Applied Mechanics**
  University of Pennsylvania, Philadelphia, USA (2020 – 2023)
  Research focus: Nanotribology and Mechanochemistry
  Advisor: Prof. Robert W. Carpick
- **Doctorate** in **Materials Science & Engineering** (2020)
  Florida International University, Miami, USA
  Dissertation title: Boron Nitride Nanotube based Lightweight Metal Matrix Composites: Microstructure Engineering and Stress-Transfer Mechanics
  Advisors: Prof. Arvind Agarwal, Prof. Benjamin Boesl
- **Bachelor of Technology** in **Mechanical Engineering** (2015)
  Indian Institute of Information Technology, Design & Manufacturing Jabalpur, India

AWARDS, HONORS & FELLOWSHIPS

1. **National Academy of Inventors Senior Member – Class of 2023** (12th NAI Annual Meeting in Washington, D.C., June 2023)**:** Recognition of success in patents, licensing, and commercialization and for producing technologies that have brought, or aspire to bring, real impact on the welfare of society.

2. **Early Career Award (2022-2023), Society of Tribologists and Lubrication Engineers** (STLE Annual Meeting & Exhibition, Long Beach, California, USA, May 2023): Recognizes the technical achievements of STLE student members, young researchers and junior-level academic faculty.
3. **Trailblazers in Engineering Fellow 2022** (College of Engineering, Purdue University, Indiana, June 2022): Program for preparing future trailblazing faculty in engineering, with a focus on academic excellence and commitment to expanding diversity and representation in engineering.
4. **Nanomaterials and Energy Prize 2020, Institute of Civil Engineers** (London, United Kingdom, October 2020): Awarded for the research paper entitled "Unraveling the multiscale damping behavior of two-dimensional layered MXene" published in *Nanomaterials and Energy* journal.
5. **Outstanding Ph.D. Graduate Award** (College of Engineering and Computing, Florida International University, Miami, August 2020)**:** Awarded for the quality and impact of research, service, mentorship, college activities and involvement in professional societies.
6. **Dissertation Year Fellowship** (University Graduate School, Florida International University, Miami, Spring 2020)**:** Awarded to doctoral students with notable publication record.
7. **Henry DeWitt Smith Scholarship, American Institute of Mining, Metallurgical, and Petroleum Engineers** (TMS Awards Ceremony, San Antonio, Texas, March 2019)**:** Awarded to graduate students in mining, metallurgical and petroleum departments of leading colleges and universities.
8. **TMS Best Paper Contest - Graduate Division - First Place** (TMS Awards Ceremony, San Antonio, Texas, March 2019)**:** Awarded for the research article titled, "Real Time Observation of Splat Sliding in Cold Sprayed Metallic Coating by In-situ Mechanical Investigations".
9. **Presidential Award, 2019 Outstanding Student Life Awards** (Division of Academic and Student Affairs, Florida International University, Miami, Florida, April 2019): In recognition of strong leadership and action towards enhancing university prestige and creating positive change in the community beyond campus.
10. **SMEC Student Prize 2019** (Study of matter at extreme conditions meeting, April 2019)**:** Awarded for the oral presentation titled, "Graphene Foam for Engineering Stiff, Tough and Impact-Resistant Structural Composites".
11. **Graduate Excellence in Materials Science (GEMS) Award, The American Ceramic Society - Basic Science Division** (MS&T Technical Meeting, Columbus, Ohio, October 2018)**:** Recognizes the outstanding scientific and academic achievements of graduate students in Materials Science and Engineering.
12. **TechConnect Defense Innovation Award** (Defense TechConnect Summit & Expo, Tampa, Florida, October 2018)**:** Awarded for the technology entitled "Boron Nitride Nanotube Based Advanced Metal Matrix Nanocomposites for Aerospace Applications".
13. **Winner, TMS Graduate Student Poster Contest, Functional Materials Division** (TMS Annual Meeting, Phoenix, Arizona, March 2018): Awarded for a research poster on high-temperature oxidative unzipping of boron nitride nanotubes.

14. **First position in Engineering Poster Presentation at the Florida Statewide Graduate Student Research Symposium, University of South Florida** (Tampa, Florida, April 2017): Awarded for a research poster entitled 'Oxidative unzipping and transformation of boron nitride nanotubes into white graphene oxide platelets'.
15. **First Position in Oral Presentation Competition at Graduate Scholarly Forum, Florida International University** (Graduate Student Appreciation Week, Miami, Florida, March 2016): Awarded for a research presentation entitled "Micro and nanoscale mechanical properties of magnesium and its alloys".
16. **Presidential Fellowship, Florida International University, Miami (2015)**: Competitive scholarship awarded to PhD-track students with potential to become outstanding scholars and future leaders in their disciplines.
17. **Proficiency Medal for Best Senior Year Project in Mechanical Engineering (2015)**: Awarded for the senior year research project entitled 'Nanoindentation creep in magnesium alloys'.
18. **Undergraduate Summer Research Fellowship (2013)**: Jointly awarded by the Indian Academy of Science, Indian National Science Academy, and National Academy of Sciences of India for pursuing research internship at the National Physical Laboratory, New Delhi (Host Scientist: Dr. Anjana Dogra).

PUBLICATIONS

Peer-reviewed journal articles

1. F. Ahmad, A.K. Kalkan, S. Puri, D. McIlroy, H. Luo, J. Qu, Pranjal Nautiyal, Electrically Accelerated Mechanochemical Film Formation by a Phosphonium Phosphate Ionic Liquid: An *In-situ* Chemical Kinetics Investigation, **Langmuir** (2026); In Press. https://doi.org/10.1021/acs.langmuir.6c00931
2. B. Tomar, Pranjal Nautiyal, Low-temperature fabrication of refractory thin films via electric field and contact stress-activated sintering of nanoparticles: An *in-situ* study, **Nano Letters** 25, 16740 (2025).
3. P. LaMascus, M. B. Elinski, D. Delghandi, Pranjal Nautiyal, J. Griffin, L. Zheng, A. Jackson, R. J. Wiacek, R. W. Carpick, Competition Between Growth and Removal in Zirconia Nanocrystal-derived Tribofilms: The Role of Co-Additives, **Tribology Letters** 72, 106 (2024).
4. M. Donato, Pranjal Nautiyal, J. Deuermeier, L. Branco, B. Saramago, R. Colaço, R. Carpick, Ionic liquids as extreme pressure additives for bearing steel applications, **Tribology Letters** 72, 101 (2024).
5. L. Lou, N. Bacca, M.S. Ma, Pranjal Nautiyal, T.G. Bifano, A. Agarwal, Multiscale mechanics of polydimethylsiloxane: A comparison of meso- and micro-cyclic deformation behavior, **Journal of Applied Polymer Science** 141, e55546 (2024).
6. S. Mohammed, Pranjal Nautiyal, T. Paul, C. Zhang, A. Agarwal, A Critique on Boron Nitride Nanotube Reinforced Metal Matrix Composites, **Critical Reviews in Solid State and Materials Sciences** 49, 482 (2024).
7. T. Thomas, A. Bakhshiannik, Pranjal Nautiyal, J.D. Hutcheson, A. Agarwal, Freeze Casting to Engineer Gradient Porosity in Hydroxyapatite-Boron Nitride Nanotube Composite Scaffold for Improved Compressive Strength and Osteogenic Potential, **Journal of the Mechanical**

Behavior of Biomedical Materials 150, 106283 (2023).

8. C. Michas, M. C. Karakan, Pranjal Nautiyal, J. G. Seidman, C. E. Seidman, A. Agarwal, K. Ekinci, J. Eyckmans, A. E. White, C. S. Chen, Engineering a living cardiac pump on a chip using high-precision fabrication, **Science Advances** 8, eabm3791 (2022).
9. S. J. Thrush, A. S. Comfort, J. S. Dusenbury, Pranjal Nautiyal, M. B. Elinski, R. W. Carpick, N. Demas, B. J. Gould, X. Han, X. Wang, H. Qu, G. C. Barber, Growth and Morphology of Thermally Assisted Sinterable Zirconia Nanoparticle Tribofilm, **Tribology International** 175, 107820 (2022).
10. Pranjal Nautiyal, J. Bustillos, T. Selvam, C. Zhang, S. Seal, B. Boesl, A. Agarwal, In-situ Investigation of Deformation Mechanisms Induced by Boron Nitride Nanotubes and Nano-Interphases in Ti-6Al-4V Alloy, **Advanced Engineering Materials** 24, 2200610 (2022).
11. Pranjal Nautiyal, V. Wiedorn, T. Thomas, N. Bacca, A. White, A. Agarwal, Unraveling Mechanisms Governing Anisotropy in Accordion-shaped Honeycomb Microlattice Fabricated by Two-Photon Polymerization, **Advanced Engineering Materials** 24, 2101190 (2022).
12. Pranjal Nautiyal, C. Zhang, B. Boesl, A. Agarwal, Interfacial deformation and failure mechanisms at the single-splat length scale revealed in-situ by indentation of cold sprayed aluminum microparticles, **Materials Science & Engineering A** 824, 141828 (2021).
13. T. Paul, Pranjal Nautiyal, C. Zhang, B. Boesl, A. Agarwal, Role of in-situ splat sintering on elastic and damping behavior of cold sprayed aluminum coatings, **Scripta Materialia** 204, 114125 (2021).
14. L. Lou, K.O. Lopez, Pranjal Nautiyal, A. Agarwal, Integrated Perspective of Scaffold Designing and Multiscale Mechanics in Cardiac Bioengineering, **Advanced NanoBiomed Research** 1, 2100075 (2021).
15. Pranjal Nautiyal, N. Denis, T. Dolmetsch, C. Zhang, B. Boesl, A. Agarwal, Interface Engineering and Direct Observation of Strengthening Behavior in Field-Sintered Boron Nitride Nanotube-Magnesium Alloy Composite, **Advanced Engineering Materials** 22, 2000170 (2020).
16. T. Thomas, A. Rubfiaro, Pranjal Nautiyal, R. Brooks, D. Dickerson, J. He, A. Agarwal, Extrusion 3D Printing of Porous Silicone Architectures for Engineering Human Cardiomyocyte-Infused Patches Mimicking Adult Heart Stiffness, **ACS Applied Bio Materials** 3, 5865 (2020).
17. X. Lu, Pranjal Nautiyal, J. Bustillos, A. Loganathan, C. Zhang, Y. Chen, B. Boesl, A. Agarwal, Hydroxylated boron nitride nanotube-reinforced polyvinyl alcohol nanocomposite with simultaneous improvement of mechanical and thermal properties, **Polymer Composites** 41, 5182 (2020).
18. C. Young, C. Zhang, A. Loganathan, Pranjal Nautiyal, B. Boesl, and A. Agarwal, Densification and Oxidation Behavior of Spark Plasma Sintered Hafnium Diboride-Hafnium Carbide Composite, **Ceramics International** 46, 14625 (2020).
19. J. Bustillos, X. Lu, Pranjal Nautiyal, C. Zhang, B. Boesl, A. Agarwal, Boron Nitride Nanotube Reinforced Titanium Composite with Controlled Interfacial Reactions by Spark Plasma Sintering, **Advanced Engineering Materials** 22, 2000702 (2020).

20. Pranjal Nautiyal, C. Zhang, V. K. Champagne, B. Boesl, A. Agarwal, In-situ creep deformation of cold-sprayed aluminum splats at elevated temperatures, **Surface & Coatings Technology** 372, 353-360 (2019).
21. Pranjal Nautiyal, C. Zhang, A. Loganathan, B. Boesl, A. Agarwal, High-Temperature Mechanics of Boron Nitride Nanotube "Buckypaper" for Engineering Advanced Structural Materials, **ACS Applied Nanomaterials** 2, 4402-4416 (2019).
22. S. Bhusal, C. Zhang, J. Bustillos, Pranjal Nautiyal, B. Boesl, A. Agarwal, A Computational Approach for Predicting Microstructure and Mechanical Properties of Plasma Sprayed Ceramic Coatings from Powder to Bulk, **Surface & Coatings Technology** 374, 1 (2019).
23. T. Thomas, C. Zhang, Pranjal Nautiyal, B. Boesl, A. Agarwal, 3D Graphene Foam Reinforced Low-Temperature Ceramic with Multifunctional Mechanical, Electrical, and Thermal Properties, **Advanced Engineering Materials** 21, 1900085 (2019).
24. A. Loganathan, Pranjal Nautiyal, B. Boesl, A. Agarwal, Unraveling the Multiscale Damping Properties of 2D Layered MXene, **Nanomaterials and Energy** 8, 84 (2019).
25. Pranjal Nautiyal, M. Mujawar, B. Boesl, A. Agarwal, In-situ Mechanics of 3D Graphene Foam Based Ultra-stiff and Flexible Metallic Metamaterial, **Carbon** 137, 502 (2018).
26. Pranjal Nautiyal, C. Zhang, B. Boesl, A. Agarwal, Non-Equilibrium Wetting and Capture of Boron Nitride Nanotubes in Molten Aluminum During Plasma Spray, **Scripta Materialia** 151, 71 (2018).
27. Pranjal Nautiyal, B. Boesl, A. Agarwal, The Mechanics of Energy Dissipation in a Three-Dimensional Graphene Foam with Macroporous Architecture, **Carbon** 132, 59 (2018).
28. Pranjal Nautiyal, C. Zhang, V. K. Champagne, B. Boesl, A. Agarwal, In-situ Mechanical Investigation of the Deformation of Splat Interfaces in Cold-Sprayed Aluminum Alloy, **Materials Science & Engineering A** 737, 297 (2018).
29. L. Fontoura, Pranjal Nautiyal[#], A. Loganathan, B. Boesl, A. Agarwal, Nacre-Inspired Graphene/Metal Hybrid by In-situ Cementation Reaction and Joule Heating, **Advanced Engineering Materials** 20, 1800518 (2018). [[#]Co-First Author with Luiza Fontoura]
30. A. Idowu, Pranjal Nautiyal, L. Fontoura, A. Loganathan, B. Boesl, A. Agarwal, Multi-Scale Damping of Graphene Foam-Based Polyurethane Composites Synthesized by Electrostatic Spraying, **Polymer Composites** 40, E1862 (2018).
31. M. Antillon, Pranjal Nautiyal, A. Loganathan, B. Boesl, A. Agarwal, Strengthening in Boron Nitride Nanotube Reinforced Aluminum Composites Prepared by Roll Bonding, **Advanced Engineering Materials** 20, 1800122 (2018).
32. T. Thomas, C. Zhang, A. Sahu, Pranjal Nautiyal, A. Loganathan, T. Laha, B. Boesl, A. Agarwal, Effect of graphene reinforcement on the mechanical properties of Ti_2AlC ceramic fabricated by spark plasma sintering, **Materials Science & Engineering A** 728, 45 (2018).
33. Pranjal Nautiyal, B. Boesl, A. Agarwal, Harnessing three dimensional anatomy of graphene foam to induce superior damping in hierarchical polyimide nanostructures, **Small** 13, 1603473 (2017).

34. Pranjal Nautiyal, A. Gupta, S. Seal, B. Boesl, A. Agarwal, Reactive wetting and filling of boron nitride nanotubes by molten aluminum during equilibrium solidification, **Acta Materialia** 126, 124 (2017).
35. L. Embrey, Pranjal Nautiyal[#], A. Loganathan, A. Idowu, B. Boesl, A. Agarwal, 3D graphene foam induces multifunctionality in epoxy nanocomposites by simultaneous improvement in mechanical, thermal and electrical properties, **ACS Applied Materials & Interfaces** 9, 39717 (2017). [[#]Co-First Author with Leslie Embrey]
36. Pranjal Nautiyal, L. Embrey, B. Boesl, A. Agarwal, Multi-scale mechanics and electrical transport in a free-standing 3D architecture of graphene and carbon nanotubes fabricated by pressure assisted welding, **Carbon** 122, 298 (2017).
37. J. Bustillos, D. Montero, Pranjal Nautiyal, A. Loganathan, B. Boesl, A. Agarwal, Integration of graphene in poly (lactic) acid by 3D printing to develop creep and wear-resistant hierarchical nanocomposites, **Polymer Composites** 39, 3877 (2017).
38. A. Loganathan, A. Sharma, C. Rudolf, C. Zhang, Pranjal Nautiyal, S. Suwas, B. Boesl, A. Agarwal, In-situ deformation mechanism and orientation effects in sintered 2D boron nitride nanosheets, **Materials Science & Engineering A** 708, 440 (2017).
39. Pranjal Nautiyal, A. Loganathan, R. Agrawal, B. Boesl, C. Wang, A. Agarwal, Oxidative unzipping and transformation of high aspect ratio boron nitride nanotubes into white graphene oxide platelets, **Scientific Reports** 6, 29498 (2016).
40. Pranjal Nautiyal, C. Rudolf, A. Loganathan, C. Zhang, B. Boesl, A. Agarwal, Directionally aligned ultra-long boron nitride nanotube induced strengthening of aluminum-based sandwich composite, **Advanced Engineering Materials** 18, 1747 (2016).
41. Pranjal Nautiyal, J. Jain, A. Agarwal, Influence of microstructure on scratch induced deformation mechanisms in AZ80 magnesium alloy, **Tribology Letters** 61, 29 (2016).
42. Pranjal Nautiyal, J. Jain, A. Agarwal, Influence of Loading Path and Precipitates on Indentation Creep Behavior of Mg-6 wt.%Al-1 wt.%Zn, **Materials Science & Engineering A** 650, 183 (2016).
43. K. Sambhava, Pranjal Nautiyal, J. Jain, Model based phenomenological and experimental investigation of nanoindentation creep in pure Mg and AZ61 alloy, **Materials & Design** 105, 142 (2016).
44. Pranjal Nautiyal, J. Jain, A. Agarwal, A Comparative Study of Indentation Induced Creep in Pure Magnesium and AZ61 Alloy, **Materials Science & Engineering A** 630, 131 (2015)**.**
45. Pranjal Nautiyal, M. M. Seikh, O. Lebedev, A. K. Kundu, Sol-Gel Synthesis of Fe-Co Nanoparticles & Magnetization Study, **Journal of Magnetism and Magnetic Materials** 377**,** 402 (2015).
46. Pranjal Nautiyal, M. M. Seikh, V. Pralong, A. K. Kundu, Influence of bismuth on the magnetic & electrical properties of La_2MnNiO_6, **Journal of Magnetism and Magnetic Materials** 347, 111 (2013).
47. A. K. Kundu, M. M. Seikh, Pranjal Nautiyal, Bismuth Centred Magnetic Perovskites: A Projected Multiferroic, **Journal of Magnetism and Magnetic Materials** 378, 506 (2014).

48. V. K. Jha, Pranjal Nautiyal, M. M. Seikh, R. Chatterjee, R. Mahendiran, A. K. Kundu, Heat capacity, thermopower and magnetoresistance effects in multiferroic $La_{0.5}Bi_{0.5}Mn_{0.5}Fe_{0.5}O_3$, **Journal of Materials Science** 48, 7629 (2013).

Book

Pranjal Nautiyal, B. Boesl, A. Agarwal, In-situ Mechanics of Materials: Principles, Tools, Techniques and Applications, **Springer International Publishing**, DOI: 10.1007/978-3-030-43320-8 (2020).

Book Chapter

Pranjal Nautiyal, Sohail M.A.K. Mohammed, Kazue Orikasa, Arvind Agarwal, *Engineering Lightweight Composites for Extreme Environments* in Nanotubes and Nanosheets: The Science and Applications of White Graphene, 2025, CRC Press.

PATENTS AND INVENTION DISCLOSURES

1. **P. Nautiyal,** B. Tomar, F. Ahmad, Method of manufacturing wear-resistant nanocomposite coatings at low temperatures, Invention ID: 2025IDF0001 (Invention Disclosure submitted to OSU in 2024).
2. A. Agarwal, B. Boesl, **P. Nautiyal**, C. Rudolf, C. Zhang, *Aluminum Boron Nitride Nanotube Composites and Method for Making the Same*, US Patent 11,148,201 (Granted in 2021; **Licensed**).
3. A. Agarwal, **P. Nautiyal**, B. Boesl, *Boron Nitride Nanotube-Magnesium Alloy Composites and Manufacturing Methods Thereof,* US Patent 11,131,007 (Granted in 2021; **Licensed**)
4. A. Agarwal, **P. Nautiyal**, B. Boesl, *Boron Nitride Nanotube-Magnesium Alloy Composites and Manufacturing Methods Thereof,* US Patent 10,947,607 (Granted in 2021; **Licensed**)
5. A. Agarwal, B. Boesl, A. Idowu, **P. Nautiyal**, J. Bustillos, *Shape Memory-Based Self-Healing Polymer Composite Reinforced with Graphene Foam*, US Patent 11,059,948 (Granted in 2021).
6. A. Agarwal, T. Paul, C. Zhang, **P. Nautiyal**, *Metal Nanoparticle Composites and Manufacturing Methods Thereof by Ultrasonic Casting*, US Patent 10,941,464 (Granted in 2021; **Licensed**).
7. A. Agarwal, B. Boesl, C. Zhang, T. Thomas, **P. Nautiyal**, *Method to Produce Graphene Foam Reinforced Low Temperature Co-fired Ceramic (LTCC) Composite,* US Patent 10,961,162 (Granted in 2020).
8. A. Agarwal, B. Boesl, C. Zhang, T. Thomas, **P. Nautiyal**, *Method to Produce Graphene Foam Reinforced Low Temperature Co-fired Ceramic (LTCC) Composite,* US Patent 10,807,915 (Granted in 2020).

SELECTED PRESENTATIONS IN CONFERENCES AND RESEARCH MEETINGS

1. **Invited Talk:** Shining light on the mechanochemistry of catalytic alloys and ionic liquids using in-situ methods, **TMS Annual Meeting & Exhibition**, San Diego, California, USA (March 2026).

2. **Invited Webinar:** Mechanochemistry at Sliding Contacts, **Surface Ventures** (Sept 2025).
3. Tribosintering of nanocrystals – Manufacturing wear-resistant TiO2 coatings at ambient temperature, **TMS Annual Meeting & Exhibition**, Las Vegas, Nevada, USA (March 2025).
4. **Invited Lecture:** Mechanically-Assisted Manufacturing of High-Performance Structural Materials, **American Society of Mechanical Engineers – Central Oklahoma Section**, Oklahoma State University, Stillwater, OK (Jan 2025).
5. **Invited Webinar**: Tribosintering of nanocrystals – Manufacturing wear-resistant metal oxide coatings at ambient temperature, **TriboNet** (Nov 2024).
6. In-situ manufactured coatings with exceptional wear resistance: Exploiting friction to sinter TiO_2 nanoparticles at sliding/rolling contacts, **Society of Tribologists and Lubrication Engineers (STLE) E-Mobility Conference,** Detroit, MI (Oct 2024).
7. **Invited Talk (Online):** Interfacial Deformation Mechanisms in Cold Sprayed Coatings: An In-situ Study, International Conference on Advancements in Thermal Spray 2024, Indian Institute of Technology Patna, India (July 2024).
8. Room temperature sintering of TiO_2 nanoparticles: Exploiting friction to manufacture wear-resistant coatings, **STLE Annual Meeting 2024**, Minneapolis, MN (May 2024).
9. **Invited Seminar:** Mechanically-assisted manufacturing of structural alloys and composites, **Undergraduate Research Symposium at Florida International University**, Miami, FL (November 2023).
10. Mechanochemical synergy between metal oxide nanocrystals and surface-active molecules at lubricated contacts: An in-situ atomic force microscopy study, **STLE Annual Meeting 2023**, Long Beach, CA (May 2023).
11. Studying mechanochemical reactions at mixed sliding-rolling contacts, **American Chemical Society Fall 2022**, Chicago, Illinois, USA (August 2022).
12. **Invited:** Uncovering mechanochemistry of surface-active molecules by Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS), **Singh Center TESCSAN – UPenn PFIB Workshop**, Philadelphia, Pennsylvania, USA (June 2022).
13. Metal oxide nanocrystal anti-wear additives: Tribosintering vs. tribochemistry at lubricated sliding/rolling contacts (Poster), **2022 Gordon Research Conference on Tribology**, Lewiston, Maine, USA (June 2022).
14. Uncovering Mechanochemical Pathways to Obtaining Low Friction, Anti-wear Lubricants by In-situ Atomic Force Microscopy, **STLE Annual Meeting**, Orlando, Florida, USA (May 2022).
15. Real Time Imaging of Deformation Mechanisms in Boron Nitride Nanotube-Metal Matrix Composites at Multiple Length Scales, **TMS Annual Meeting & Exhibition**, San Diego, California, USA (February 2020).
16. In-situ Study of Multi-Scale Deformation in Two-photon Polymerized Microlattices, **MS&T Technical Meeting & Exhibition**, Portland, Oregon, USA (October 2019).
17. Determination of Bonding Strength of Cold Sprayed Splats Using In-situ Nano-scratch Technique, **MS&T Technical Meeting & Exhibition**, Portland, Oregon, USA (October 2019).
18. Mechanics of Cold Sprayed Materials: From Splats to Coatings, **Cold Spray Action Team**, Boston, Massachusetts, USA (June 2019).

19. Graphene Foam-Based Multifunctional Polymer Composites for Self-Healing, De-icing and Strain-sensing Applications, **Study of matter at extreme conditions**, Miami-Caribbean Cruise (April 2019).
20. Graphene Foam for Engineering Stiff, Tough and Impact-Resistant Structural Composites, **Study of matter at extreme conditions**, Miami-Caribbean Cruise (April 2019).
21. Real Time Deformation Mechanisms of Advanced Nanocomposites by High-Resolution In-situ Testing, **TMS Annual Meeting & Exhibition**, San Antonio, Texas, USA (March 2019).
22. Real-time Deformation in Cold Sprayed Aluminum Alloy at Elevated Temperatures by In Situ Nanoindentation, **TMS Annual Meeting & Exhibition**, San Antonio, Texas, USA (March 2019).
23. Scalable Nanomanufacturing Approaches to Develop Advanced Metal Matrix Nanocomposites, **TMS Annual Meeting & Exhibition**, San Antonio, Texas, USA (March 2019).
24. In-situ Investigation of Thermo-Mechanical Properties of a Free-standing Boron Nitride Nanotube Buckypaper, **TMS Annual Meeting & Exhibition**, San Antonio, Texas, USA (March 2019).
25. Multi-Scale Mechanics of 3D Printed Honeycomb Structures for Cardiac Tissue Engineering, **22nd Annual Boston University Photonics Center Symposium on Frontiers of Cardiac Tissue Engineering,** Boston, Massachusetts, USA (November 2018).
26. Scalable Manufacturing Routes to Develop Boron Nitride Nanotubes Based Metal Matrix Composites, **International Mechanical Engineering Congress & Exposition**, Pittsburgh, Pennsylvania, USA (November 2018).
27. 3D Graphene Foam for Engineering Advanced Composites and Metamaterials, **International Mechanical Engineering Congress & Exposition**, Pittsburgh, Pennsylvania, USA (November 2018).
28. Boron Nitride Nanotube Based Advanced Metal Matrix Nanocomposites for Aerospace Applications, **Defense TechConnect,** Tampa, Florida, USA (October 2018).
29. Integrating Boron Nitride Nanotubes in Aluminum for Superior Mechanical Properties (Poster), **MS&T Technical Meeting & Exhibition**, Columbus, Ohio, USA (October 2018).
30. In-situ Mechanics of a Super-lightweight and Ultra-stiff 3D Graphene-Metal Metamaterial, **MS&T Technical Meeting & Exhibition**, Columbus, Ohio, USA (October 2018).
31. Scalable Manufacturing of Boron Nitride Nanotube Based Metal Matrix Composites, **14th International Ceramics Congress,** Perugia, Umbria, Italy (June 2018).
32. In situ Mechanical Investigation of Splat Sliding in Cold Sprayed 6061Al Coatings, **International Thermal Spray Conference 2018**, Orlando, Florida, USA (May 2018).
33. Pathways for Engineering Boron Nitride Nanotube Based High-Strength Metal Matrix Composites, **AeroMat 2018**, Orlando, Florida (May 2018).
34. *In Situ* Deformation Characteristics of a Free-standing Three-dimensional Graphene Foam-aluminum Nanohybrid, **TMS Annual Meeting & Exhibition**, Phoenix, Arizona, USA (March 2018)
35. Boron Nitride Nanotube Based High-strength Aluminum Composites (Poster), **TMS Annual Meeting & Exhibition**, Phoenix, Arizona, USA (March 2018)

36. Boron nitride nanotube reinforced aluminum composite via solidification processing, **MS&T Technical Meeting & Exhibition**, Pittsburgh, Pennsylvania, USA (Oct 2017)
37. Boron Nitride Nanotube Induced Strengthening of Lightweight Aluminum Composite for Fuel-Efficient Aerospace & Automotive Structures, **NanoFlorida 2017**, Miami, Florida, USA (Sept 2017)
38. Splat sliding in cold-sprayed coatings (Poster), **Cold Spray Action Team**, Boston, Massachusetts, USA (June 2017)
39. Oxidative unzipping and transformation of boron nitride nanotubes into 'white graphene oxide' platelets (Poster), **Florida Statewide Graduate Research Symposium**, Tampa, Florida, USA (April 2017)
40. Multi-scale mechanics and electrical transport in a free-standing 3D architecture of graphene and carbon nanotubes fabricated by pressure assisted welding, **Study of Matter at Extreme Conditions**, Miami-Eastern Caribbean (April 2017)
41. High temperature transformations in boron nitride nanotubes, **MS&T Technical Meeting & Exhibition**, Salt Lake City, Utah, USA (Oct 2016)
42. Nano-scale creep and scratch-induced deformation in Mg alloys (Poster), **Florida Statewide Graduate Research Symposium**, Gainesville, Florida, USA (April 2016)

TECHNICAL SKILLS

I am an experimentalist with expertise in

- **Materials processing:** Cold spray additive manufacturing of metals; Powder metallurgy
- **Experimental mechanics:** Atomic and Friction Force Microscopy (AFM, FFM), Nano- and microindentation, In-situ tribometry to study friction, wear, and lubrication mechanisms, In-situ SEM Mechanical Testing
- **Nanoscale materials characterization:** Scanning Electron Microscopy (SEM), Electron Dispersive X-ray Spectroscopy (EDS), Focused Ion Beam (FIB) milling, Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS), White Light Interferometry (WLI), X-ray Diffraction (XRD)

FUNDED PROJECTS

As the Lead (Principal/ Science) Investigator:

1. **EPSCoR Research Fellows: NSF: Mechanocatalysis with MXenes - Mechanically Driven Tribofilm Formation at Sliding Interfaces** (May 2026, *ongoing*)
   Sponsor: National Science Foundation
   Amount of Funding: $294,412
   Collaborator: Prof. Babak Anasori, Purdue University
2. **Manufacturing Diamond-like Carbon Films via Mechanocatalysis of Hydrocarbons: Linking Contact Mechanics and Reaction Kinetics** (Recommended for Funding; starting in July 2026)
   Sponsor: American Chemical Society Petroleum Research Fund
   Amount of Funding: $110,000

Collaborators: Prof. Kaan Kalkan, Oklahoma State University; Dr. Anton levlev, Oak Ridge National Laboratory

3. **Vegetable Oils as Sustainable Feedstock for Mechanocatalytic Fabrication of Diamond-like Carbon Films** (Jan 2026, *ongoing*)
   Sponsor: United States Department of Agriculture – Sun Grant Program
   Amount of Funding: $84,034
   Co-investigators: Prof. Ritesh Sachan (Co-PI)
4. **Lubrication Mechanisms of Friction Modifiers Under Electric Field: Towards Enabling Ultra-Low Viscosity Lubricants for Electrified Vertical Takeoff and Landing Vehicles** (Aug 2024, *ongoing*)
   Sponsor: National Aeronautics and Space Administration
   Amount of Funding: $99,532
   Collaborators: Dr. Jun Qu and Dr. Huimin Luo, Oak Ridge National Laboratory; Prof. Kaan Kalkan, Oklahoma State University; Prof. Dave McIlroy, Oklahoma State University

As the Co-Principal Investigator:

5. **MRI: Track 1 Acquisition of a Cold Spray System to Enable Multidisciplinary Research, Education, and Training** (Sept 2025, *ongoing*)
   Sponsor: National Science Foundation
   Amount of Funding: $625,195
   Co-investigators: Prof. Sandip Harimkar (lead PI), Prof. Aurelie Azoug (Co-PI); Prof. Chitrarth Prasad (Co-PI); Prof. Chenang Liu (Co-PI)

TEACHING AND MENTORSHIP

- **Co-Instructor, Introduction to Mechanical and Aerospace Design** (MAE 3153), Spring 2025, Fall 2025, Spring 2026
  Mechanical and Aerospace Engineering, Oklahoma State University
- **Instructor, Metal Additive Manufacturing** (MAE 4020/5020), Fall 2024
  Mechanical and Aerospace Engineering, Oklahoma State University
- **Instructor, Mechanical Metallurgy** (MAE 4333), Spring 2024
  Mechanical and Aerospace Engineering, Oklahoma State University
- **Faculty Mentor, Interdisciplinary Design Project** (MAE 4344), Fall 2023
  Mechanical and Aerospace Engineering, Oklahoma State University
  Course Instructor: Prof. Laura Southard
  Project Topic: Velocity Prediction Tool for Cold Spray Applications
- **Mentorship of graduate and undergraduate students at OSU:**
  1. Mr. Bunty Tomar, PhD Student, Oklahoma State University (Spring 2024 - Present)
     Project: Mechanisms of self-lubrication in multicomponent alloys
  2. Mr. Foyez Ahmad, PhD Student, Oklahoma State University (Spring 2024 - Present)
     Project: Mechanochemistry of lubricants at electrified contacts

3. Mr. Chandler Saxon, MS Student, Oklahoma State University (Fall 2025 - Present)
   Project: Bonding mechanisms in cold spray
4. Mr. Zidan Mohiuddin, MS Student, Oklahoma State University (Fall 2025 - Present)
   Project: Nanomanufacturing of 2D metal carbide thin films
5. Mr. Hayden Dailey, Undergraduate Research Scholar, Oklahoma State University (Fall 2025 – Present)
   Project: Cold spray additive manufacturing
6. Mr. Corban Muller, Undergraduate Research Scholar, Oklahoma State University (Fall 2024 – Spring 2025)
   Project: Nanolubricants for electrified contacts

- **Membership of PhD and MS Dissertation Committees at OSU:**
  1. Bunty Tomar, PhD in Mechanical Engineering (2024 - Present)
     My role: Chair and Advisor
  2. Foyez Ahmad, PhD in Mechanical Engineering (2024 - Present)
     My role: Chair and Advisor
  3. Sahar Riazi Tabrizi, PhD in Mechanical Engineering (2024 - Present)
     My role: Member
  4. Prudhvi Pola, PhD in Materials Science and Engineering (2024 - Present)
     My role: Member
  5. Prabhat Prajapati, Ph.D. in Mechanical Engineering (2025 - Present)
     My role: Member
  6. Fardin Mahatab, PhD in Mechanical Engineering (2026 - Present)
     My role: Member
  7. Fuad Ahmed, MS in Mechanical Engineering (2026 - Present)
     My role: Member
  8. Sumaiya Binta Sadeque, MS in Mechanical Engineering (2025 - Present)
     My role: Member
  9. Arnob Das, MS in Mechanical Engineering (2025)
     My role: Member

SERVICE, OUTREACH, AND LEADERSHIP

A. Professional Societies

- **Membership in Professional Societies:** Society of Tribologists and Lubrication Engineers (STLE), The Minerals, Metals and Materials Society (TMS), Elected Senior Member of National Academy of Inventors (NAI), Elected Full Member of Sigma Xi (The Scientific Research Honor Society)
- **Co-organizer, Symposium on Advanced Real Time Imaging, TMS Annual Meeting & Exhibition (The Minerals, Metals & Materials Society)**
  - **TMS 2025,** March 23–27, 2025, Las Vegas, Nevada, USA
  - **TMS 2024**, March 3–7, 2024, Orlando, Florida, USA

- **TMS 2023,** March 19–23, 2023, San Diego, California, USA
- **TMS 2022,** Feb 27–March 3, 2022, Anaheim, California, USA

- **Member of Emerging Professionals Committee,** The Minerals, Metals and Materials Society (TMS), 2025 – Present
- **Member of Technical Committee, Society of Tribologists and Lubrication Engineers (STLE)**
  - **Chair, Nanotribology Committee, STLE Annual Meeting 2026**, to be held May 17-21, 2026, in New Orleans, USA**.**
  - **Vice Chair, Nanotribology Committee, STLE Annual Meeting 2025**, May 18-22, 2025, Atlanta, USA**.**
  - **Paper Solicitation Chair, Nanotribology Committee, STLE Annual Meeting 2024**, May 18-23, 2024, Minneapolis, USA**.**
- **Member of Early Career Awards Committee, Society of Tribologists and Lubrication Engineers**, 2023-Present.
- **Session Chair in Conferences:**
  - **Symposium on Nanotribology, STLE Annual Meeting 2025**, May 18-22, 2025, Atlanta, USA
  - **Symposium on Advanced Real Time Imaging, TMS Annual Meeting & Exhibition,** March 23–27, 2025 in Las Vegas, Nevada, USA
  - **Symposium on Nanotribology, STLE Annual Meeting 2024**, May 18-23, 2024, in Minneapolis, USA
  - **Symposium on Advanced Real Time Imaging, TMS Annual Meeting & Exhibition,** March 3–7, 2024, Orlando, Florida, USA
  - **Symposium on Surface Interactions in Materials – Chemical and Physical Interactions, TMS Annual Meeting & Exhibition**, March 11-15, 2018, Phoenix, Arizona, USA.

B. Scientific Review Activities

- **Technical Proposal Review:**
  - **National Science Foundation** Advanced Manufacturing Program (2025)
  - **American Chemical Society** Petroleum Research Fund Program (2025)
  - **French National Research Agency** Metallic and Inorganic Materials Panel (2025)
  - **National Science Foundation** Small Business Innovation Research / Small Business Technology Transfer Program (2024-2025)
- **Reviewer to International Journals:** Nanoscale (Royal Society of Chemistry), Small (Wiley), ACS Applied Nano Materials (American Chemical Society), ACS Applied Materials & Interfaces (American Chemical Society), Chemical Reviews (American Chemical Society), Physical Review Applied (American Physical Society), Review of Scientific Instruments (American Institute of Physics Publishing), Tribology Letters (Springer), Advanced Materials Interfaces (Wiley), ACS Sustainable Chemistry &

Engineering (American Chemical Society), Tribology International (Elsevier), Surface and Coatings Technology (Elsevier), Journal of Manufacturing Science and Engineering (ASME), Advanced Engineering Materials (Wiley), Molecular Systems Design & Engineering (Royal Society of Chemistry), Metallurgical and Materials Transactions A (Springer), Tribology Transactions (Taylor & Francis), Computational Materials Science (Elsevier), Advanced Electronic Materials (Wiley), Materials Chemistry and Physics (Elsevier), New Journal of Chemistry (Royal Society of Chemistry), Journal of Molecular Liquids (Elsevier), Materials Today Advances (Elsevier), Plasmonics (Springer)

- **Reviewer for Conference Publications:**
  25th International Conference on Wear of Materials

C. Student Activities at Oklahoma State University

- **Co-Advisor for ASME Student Chapter,** Dec 2023 – Present, Mechanical and Aerospace Engineering, Oklahoma State University, Stillwater, Oklahoma.
- **Faculty Interviewer for CEAT Scholars Program** (2023, 2024)**,** College of Engineering, Architecture and Technology, Oklahoma State University, Stillwater, Oklahoma.
- **Faculty Evaluator for Senior Design Projects** (2023, 2024, 2025), College of Engineering, Architecture and Technology, Oklahoma State University, Stillwater, Oklahoma.

D. Outreach Activities

- Faculty Mentor for a Design Project, **2024 Summer Bridge Program** for incoming first-year students**,** College of Engineering, Architecture and Technology (CEAT), Oklahoma State University, July 29-31, 2024.
  Project topic: Synthesis and frictional properties of nanolubricants
- Co-led hands-on demonstrations for **2023 Philly Materials Day**. The event was attended by K-12 students from Philadelphia schools. (link)
  Demo theme: Tribology, the Science of Friction
- Directed an outreach video for **2021 Virtual Philly Materials Day**, titled "Tribology: Principles of Friction, Adhesion, Wear, and Lubrication" (link)
- Participated in demonstrations, presentations and lab tours for the **Engineering Expo** outreach event (2016, 2017, 2018, 2019) organized by the Florida International University College of Engineering & Computing. The event is attended by over 1,500 K-12 students from Miami-Dade and Broward County schools.
- **Industry Outreach:** Represented the Innovation Ecosystem Thrust of CELL-MET Engineering Research Center at the TERMIS Conference in Kyoto, Japan (September 4-7, 2018) to establish partnerships with industries in biomedicine and tissue engineering.
- **Member of Student Advisory Board, Advanced Materials Engineering Research Institute** at Florida International University (Aug 2017 – July 2018)
- **Chair of Material Advantage** at Florida International University (May 2017-July 2018)
- **Secretary of Council for Student Organizations** at Florida International University (May 2017-May 2018)

- **Secretary of Material Advantage Chapter** at Florida International University (Aug 2015 – April 2017)

COLLABORATORS

Andrew Jones	Scientist, Center for Integrated Nanotechnologies	Los Alamos National Laboratory
Arvind Agarwal	Professor and Chair of Mechanical Engineering	Virginia Commonwealth University
Babak Anasori	Associate Professor of Materials and Mechanical Engineering	Purdue University
Benjamin Boesl	Professor of Mechanical and Materials Engineering	Florida International University
David McIlroy	Professor of Physics	Oklahoma State University
Huimin Luo	Senior Research Scientist, Chemical Process Scale Up Group	Oak Ridge National Laboratory
Jun Qu	Group Leader, Surface Engineering and Tribology	Oak Ridge National Laboratory
Kaan Kalkan	Associate Professor of Mechanical and Aerospace Engineering	Oklahoma State University
Robert Carpick	Professor of Mechanical Engineering and Applied Mechanics	University of Pennsylvania
Ritesh Sachan	Associate Professor of Mechanical and Aerospace Engineering	Oklahoma State University
Sandip Harimkar	Professor of Mechanical and Aerospace Engineering	Oklahoma State University
Timothy Krantz	Senior Technologist, Rotordynamic Systems	NASA John H. Glenn Research Center
Ying Chen	Professor and Chair in Nanotechnology at the Institute for Frontier Materials	Deakin University

MEDIA COVERAGE

- News article on the NSF MRI award: OSU's new cold spray system positions Oklahoma at the forefront of advanced manufacturing
- News article on the NASA sponsored research project: MAE professor studying lubricants for electrified aircraft as part of NASA project | Oklahoma State University
- Our K12 outreach activity was featured in ***The Philadelphia Inquirer*** (February 2023): https://www.inquirer.com/news/philly-materials-science-and-engineering-day-drexel-university-20230211.html
- Penn Engineering Today Article: Pranjal Nautiyal Receives Pair of Scholarly Honors - Penn Engineering Blog (upenn.edu)
- The National Academy of Inventors announces 2023 class of Senior Members:

https://academyofinventors.org/nai-welcomes-95-new-emerging-innovators/

- Our paper on the nanoengineered cardiac pump on a chip was featured in:
  - **Eureka Alert! (AAAS):** New miniature heart could help speed heart disease cures
  - **Discovery Matters:** Despite existing since 400 BCE, animal testing may finally be at an end due to organ on a chip tech.
  - **Longevity.Technology:** New Lab Grown Miniature Heart that can Beat by Itself
  - **New Atlas:** miniPUMP heart-on-a-chip pumps liquid using real human heart cells
- Trailblazers in Engineering Fellows program: Cohort of 2022 Trailblazers in Engineering Fellows named - News - College of Engineering - Purdue University
- Our research on fabrication and mechanical investigations on a bioinspired multi-layer metal-graphene composite was featured in ***Advanced Science News***: *Mother of Pearl Inspires Next Generation of Strong and Tough Materials*
- Feature article by the Department of Mechanical and Materials Engineering Department (FIU)
  Pranjal Nautiyal: Shining Graduate Scholar Receives Prestigious Awards
- Presidential Award at the 2019 Outstanding Student Life Awards: *FIU celebrates outstanding students at annual award ceremony*
- Nanomaterials and Energy Prize for our research article on damping behavior of MXene: *ICE Publishing Awards 2020*
- AIME Henry DeWitt Smith Scholarship and TMS Best Paper Awards in the annual meeting of the Metals, Minerals and Materials Society*: TMS Honors 2019 Awardees*