

Yash Shah

material design // environmental catalysis // life cycle assessment

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Education

Duke University

PhD, Environmental Engineering

Durham, NC, USA

Aug 2023 – Jun 2026

National Institute of Technology

BTech + MTech, Chemical Engineering, Institute Silver Medalist

Rourkela, India

Aug 2016 – Aug 2021

Experience

Life Cycle Assessment (LCA) Research Analyst

BASF Corporation - Duke Joint Project, Managed by Dr. Wendel Wohlleben ↗

Durham, NC

May 2025 – May 2026

- Innovated new soil ecotoxicity factors to quantify microplastic impacts for 3 agricultural polymer coatings
- Enabled business decisions and contributed to IP by demonstrating 98% lower soil ecotoxicity vs. conventional polymers
- 20+ BASF products benefited from implementation of the developed consequential LCA method
- Coordinated with 8 member team of industry R&D and academia via communication of accomplished project objectives

Material Science and Sustainability Researcher

Duke University, Supervisor: Dr. Leanne M. Gilbertson ↗

Durham, NC

Aug 2023 – Jun 2026

- Established structure–property–sustainability relationships for engineered nanomaterials in environmental applications
- Led collaborative LCAs to identify environmental hotspots for guiding process scale-up design and material innovations
- Developed non-metal doping strategies to overcome functional limitations in photocatalytic nanomaterial design
- Conceived experimental approaches with material property characterization to modulate nanomaterial performance
- Managed a \$500K NSF sustainable materials R&D project and documented research into 3+ peer-reviewed articles

Research Assistant

University of Pittsburgh (research credited toward PhD at Duke, following lab relocation)

Pittsburgh, PA

Aug 2021 – Aug 2023

- Built a data-driven sustainable material optimization framework to link environmental metrics with material properties
- Evaluated embodied production energies to identify low-impact carbon materials for environmental catalysis

Research Projects

(†lead, ‡collaboration)

• Tailoring carbon nitride design to control reactive species generation†

Uncovered how surface chemistry modification of carbon nitride (CN) alters its physicochemical properties to gain control over specific reactive species generation in photocatalysis.

Duke University

Apr, 2025 - Dec, 2025

• Enhancing solar panel efficiency by remediating fungal buildup‡

Demonstrated the antifungal efficacy of CN materials by achieving a 4-log inactivation of the solar panel contaminant *Alternaria*, which enabled improved photovoltaic efficiency.

Duke University

Aug, 2025 - Mar, 2026

• Enabling improved plant growth using carbon nanoparticles‡

Investigated seed priming with a range of CN formulations to identify the material properties that mitigate water and salinity stress and promote enhanced plant growth.

Duke University

Aug, 2025 - Dec, 2025

• Respiratory pathogen inactivation in drinking water using CN†

Designed an innovative reservoir reactor achieving >99.99% photocatalytic inactivation of *P. aeruginosa* catalyzed by modified CN materials synthesized from low-cost urea.

Duke University

May, 2024 - Aug, 2025

• Decarbonization of CN material and application in hydrogen production‡

Led a cradle-to-use LCA to identify ways for decarbonizing hydrogen production via CN catalyzed water splitting. Cut down process carbon emissions by 53% relative to lab-scale.

Duke x Ben-Gurion Univ.

Nov, 2024 - May, 2025

• Blueprinting carbon nanoparticle scale-up with LCA‡

Performed LCA hotspot analysis to guide industrial scaling of functional carbon nanoparticle synthesis, achieved a 75% lower modeled carbon footprint than conventional methods.

Duke x Univ. of Miami

Oct, 2023 - Mar, 2025

• O-doped CN for enhanced visible-light reactive species production†

Designed oxygen-doped carbon nitride that delivers 10x higher reactive species output under non-UV light by tuning its optical, structural properties, and surface chemistry.

Duke University

Aug, 2023 - Nov, 2024

• Balancing functional properties and environmental impact of CN†

Conceived a novel material selection framework that visualizes sustainability metrics alongside functional properties of carbon nanomaterials to guide nanomaterial design decisions.

University of Pittsburgh

Jan, 2022 - Aug, 2023

- **Catalytic ozonation to remove water pollutants†**
Developed a greener graphene oxide (GO) synthesis by integrating an acid recycling protocol, and achieved 93% degradation of recalcitrant water pollutants using synthesized GO.
- **Toward a green and sustainable campus dwelling†**
Analyzed the lifestyle habits of 6,000 students, estimating CO₂-equivalent emissions from food, electricity, plastics' consumption to benchmark results with the Indian standards.

University of Saskatchewan
May, 2019 - Aug, 2019

NIT Rourkela
Dec, 2018 - Apr, 2019

Mentorship and Teaching Assistantship

- **Guest Lecturer, Carbon - An Element of Change and Life**
Inspired MS students to tackle critical energy and environmental issues by demonstrating how the physicochemical properties of carbon materials can be tailored for sustainable solutions.
- **Teaching Assistant, Material Design in a Circular Economy**
Assisted with course administration, preparation of assignment and exam materials, and provided student support through weekly office hours.
- **Research Mentor, The Gilbertson Lab**
Mentored 3 MS and 2 BS students in materials' synthesis and characterization, from experimental design through data analysis and reporting, and ISO 14044 LCA techniques.

Duke University
Aug, 2025 – Dec, 2025

Duke University
Aug, 2024 – Dec, 2024

Duke University
Aug, 2023 – Dec, 2025

Scholarships and Awards

- **Best Paper Presentation Award**, Chemical Engineering Congress, Jalandhar, India 2025
- **Graduate Student Travel Award**, Duke India Initiative 2024
- **Utku Best Paper Award**, Civil and Environmental Engineering, Duke University 2024
- **ARISTEIA Interdisciplinary School on Environmental Crisis Scholarship**, Euboea, Greece 2023
- **Student Researcher Award**, Sustainable Nanotechnology Organization 2023
- **Pratt-Gardner Graduate Fellowship**, Duke University 2023
- **Discussion Leader Travel Grant**, Gordon Research Seminar 2023
- **Graduate Research Assistantship**, University of Pittsburgh 2022
- **Prime Minister's Research Fellowship Nominee**, Ministry of Education, India 2021
- **Debashis Memorial Award for Best All-Rounder Student**, NIT Rourkela 2020
- **Globalink Fellowship**, Mitacs, Canada 2019
- **Best Research Poster Award**, Indian Institute of Technology, Roorkee 2018
- **All India Rank 27**, National Biotechnology Olympiad 2008

Leadership and Community Service

- **Founding Vice Chair, India Conference at Duke**
Launched the inaugural conference to promote knowledge exchange on India. Recruited and supervised a team of 20, curated a multidisciplinary agenda with various Duke schools, secured \$15,000+ in sponsorships, and coordinated logistics for 300+ attendees, 12 speakers.
- **Website Curator, CEE Departmental Symposium**
Created the symposium website, implemented content updates, and streamlined information delivery for 70+ participants across the civil and environmental engineering department.
- **Team Lead, Duke Innovation & Entrepreneurship Bootcamp**
Led a team of 5 in evaluating market viability of a water disinfection technology through ideation, human-centered design, competitor analysis, customer discovery, and storytelling.
- **Technical Head, AIChE Student Chapter**
Oversaw technical seminars, managed lab-based demonstrations, and led a team of volunteers to execute chapter activities and outreach.

Duke University
Apr 2024 – Apr 2025

Duke University
Oct 2024 - Mar 2025

Duke University
Jan 2025 - Feb 2025

NIT Rourkela
Apr 2018 – Apr 2019

Skills

Software: SimaPro for LCA (ecoinvent, USLCI databases), Microsoft Office Suite (Word, Excel, PowerPoint), OriginLab, Minitab for Statistical Analyses/Design of Experiments, Adobe Illustrator; **Experimental:** Nanomaterial Synthesis, Reactive Oxygen Species (ROS) Identification Assays, Microbiology & Cell Culture, Reactor Design & Operation, Safety Documentation, Sterilization, Chemical Hygiene & Disposal; **Material Characterization:** X-ray Photoelectron Spectroscopy (XPS), X-ray Diffraction (XRD), Diffuse Reflectance Spectroscopy, Photoluminescence, FT-IR & Raman Spectroscopy, TEM, GC-MS

Publications

- Shah, Y.**, & Gilbertson, L. M. (2025). Tuning reactive species production of graphitic carbon nitride via oxygen doping. *ACS Sustainable Chemistry & Engineering*.
- Modi, S., **Shah, Y.**, Okonkwo, O., Gilbertson, L.M., & Biswas, P. (2025). Toward Sustainable Scaled-Up Manufacturing of Lignin-Derived Carbon Nanoparticles using Furnace Aerosol Reactor: Insights from Life Cycle Assessment. *ACS Environmental Science & Technology*.
- Battula, V.R., Mark, G., Naeem, M.S., **Shah, Y.**, Volokh, M., Gilbertson, L.M., Lopez, N., & Shalom, M. (2025). Light-Driven Chemical Cascade Reduces Barriers to Hydrogen Production. *Journal of the American Chemical Society*.
- Shah, Y.**, & Gilbertson, L. M. (2024). Balancing functional properties and environmental impact of graphitic carbon nitride: a case study on boron doping syntheses. *RSC Environmental Science: Nano*, 11(1), 78–90.
- Shah, Y.**, & Gilbertson, L. M. (2026). Design-to-Performance: Establishing linkages between reactive species production and differential non-metal doping in carbon nitride. *In preparation for submission to ACS Nano*.
- Rubin, A.E., **Shah, Y.**, et al. (2026). Utilizing visible light photocatalysis for rapid water disinfection: The case study of polymeric carbon nitride. *In preparation for submission to Nature Water*.
- Mark, G., Battula, V.R., **Shah, Y.**, et al. (2026). Waste Plastic Reforming into Scalable Binder-Free Photocatalyst Panels. *In preparation for submission to journal undecided yet*.
- Shah, Y.**, Maharana, M., & Sen, S. (2022). *Peltophorum pterocarpum* leaf extract mediated green synthesis of novel iron oxide particles for application in photocatalytic and catalytic removal of organic pollutants. *Biomass Conversion and Biorefinery*.
- Shah, Y.**, & Kundu, M. (2021). A green and sustainable campus dwelling: proposition of a hybrid indicator. *Handbook of Green Engineering Technologies for Sustainable Smart Cities* (pp. 37–55). CRC Press.

Conference Presentations

- Shah, Y.**, & Gilbertson, L. M. (2025). Revealing Structure–Property–Sustainability Relationships for Predicting Design of Graphitic Carbon Nitride. *INFRAMES Fall Meeting 2025, Rennes, France*.
- Shah, Y.**, & Gilbertson, L. M. (2025). Establishing Functional Property–Reactive Performance–Environmental Impact Relationships for Graphitic Carbon Nitride through Non-Metal Doping. *Gordon Research Conference on Environmental Nanotechnology, Newry, ME*.
- Shah, Y.**, & Gilbertson, L. M. (2024). Doping of Carbon Nitride: Tweaking Atoms, Tuning Material Properties, and Trimming Environmental Impact. *Indian Chemical Engineers' Congress, Jalandhar, India*.
- Shah, Y.**, Rubin, A., & Gilbertson, L. M. (2024). Mitigating Critical Minerals Dependency Using Carbon Nanomaterials: Insights from Carbon Nitride. *SCRiMMaJE – Critical Minerals Symposium, Duke University*.
- Shah, Y.**, & Gilbertson, L. M. (2024). Heteroatom Doping of Graphitic Carbon Nitride. *American Chemical Society Central Regional Meeting, Pittsburgh, PA*.
- Shah, Y.**, & Gilbertson, L. M. (2023). Balancing Functional Properties and Environmental Impact of Graphitic Carbon Nitride. *Sustainable Nanotechnology Organization Conference, Los Angeles, CA*.
- Shah, Y.**, & Das, T. (2018). Catalytic Oxidation of Cyclohexane in Vapor Phase Using Co–Fe/Alumina Catalysts at Low Temperature. *Spark Summer Poster Symposium, Indian Institute of Technology, Roorkee, India*.

References

- Dr. Leanne M. Gilbertson — Associate Professor, Duke University, leanne.gilbertson@duke.edu
- Dr. Mark Wiesner — U.S. NAE Member and Distinguished Professor, Duke University, wiesner@duke.edu
- Dr. Pratim Biswas — U.S. NAE Member and Dean of Engineering, University of Miami, pbiswas@miami.edu