YAGUANG ZHU

Assistant professor

Department of Civil, Environmental, and Construction Engineering, Institute of Sustainability and Circular Economy, Texas Tech University

Address: 911 Boston Avenue, Lubbock, TX 79409-1023

E-mail: yaguang.zhu@ttu.edu **Phone**: (806)-834-1661

EDUCATION

Washington University in St. Louis, USA (2016-2022)

Ph.D. in Energy, Environmental and Chemical Engineering

Dissertation title: Nanoscale Interfacial Control of Ion Behaviors and $CaCO_3$ Formation in Environmental Systems

Advisor: Young-Shin Jun

Committee: Fangqiong Ling, Srikanth Singamaneni, Carl I. Steefel, Fuzhong Zhang

Nanjing University, P. R. China (2012-2016)

B.S. in Environmental Science

PROFESSIONAL EXPERIENCE

Assistant Professor (2026-present)

Department of Civil, Environmental, and Construction Engineering, *Institute of Sustainability and Circular Economy, Texas Tech University*

- Electrochemical interfaces design and characterization
- 2D materials platform for sustainable applications

Postdoctoral Research Associate (2022-2025)

Andlinger Center for Energy and the Environment, Princeton University

Advisor: Kelsey B. Hatzell

- Design and characterize 2D transition metal carbide membranes for ion sieving and separation
- Characterize bipolar membrane structure during CO_2 electrolysis (Advanced Rese
- Study CO_2 and water molecular interactions with transition metal carbide surfaces

Graduate Research Assistant (2016-2022)

Department of Energy, Environmental and Chemical Engineering, Washington University in St. Louis

Advisor: Young-Shin Jun

- Utilize synchrotron-based X-ray scattering techniques for characterizing nanomaterials
- Synthesize plasmonic nanostructures for sensing ions under nanoconfinement
- Access interactions among supercritical fluid, aqueous solutions, and solids

Undergraduate Research Assistant (2014-2016)

School of the Environment, Nanjing University

Advisor: Lena Q. Ma

- Develop *in vivo* and *in vitro* assays to assess hand-to-mouth bioavailability of lead and arsenic from contaminated soils and dust

SELECTED HONORS & AWARDS

1. Postdoctoral Researcher Presentation Award, Andlinger Center for Energy and the Environment Annual Meeting, 2025
2. Finalist for Student and Postdoc Team Science Competition at the 2025 EFRC-Hub-CMS-CCS PI Meeting, 2025
3. Certificate of Excellence Poster Presentation, Advanced Materials for Energy-Water Systems Annual Meeting, 2023
4. Graduate Student Research Impact Award, Department of Energy, Environmental and Chemical Engineering, Washington University in St. Louis, 2023
5. Mistletoe Research Fellowship, $10,000 grant for independent research, Momental Foundation, 2022
6. Graduate Student Award, Division of Environmental Chemistry, American Chemical Society, 2021
7. Certificate of Merit, ACS Division of Environmental Chemistry, 260th ACS National Meeting, 2020
8. Student Travel Award, ACS Division of Geochemistry, 257th ACS National Meeting, 2019
9. Fully supported participant for the 2017 Research Experience in Carbon Sequestration, Birmingham, Alabama. Sponsored by U.S. Department of Energy, July 22-29, 2017
10. Nanjing University–Excellent Undergraduate Student, 2015-2016
11. Nanjing University–China Merchants Bank Scholarship, 2015-2016
12. Nanjing University–National Scholarship, 2013-2014
13. Nanjing University–Second Renmin scholarship, 2012-2013

PUBLICATIONS

Published

1. **Yaguang Zhu,** Austin J. Booth, Jamila G. Eatman, Mina Kim, Yining Liu, Bidushi Sarkar, Bratin Sengupta, Xiaolin Yue, Chibueze V. Amanchukwu, Seth B. Darling, Jeffrey W. Elam, Paul Fenter, Chong Liu, and Kelsey B. Hatzell. From Molecules to Modules: Advanced Characterization of Membrane Systems. *Advanced Materials.* DOI:10.1002/adma.202513056
2. **Yaguang Zhu**, Qinsi Xiong, WooCheol Jeon, Monika Blum, Fernando Camino, George Schatz, and Kelsey B. Hatzell. Water content modulation enables selective ion transport in 2D MXene membranes (2025). *PNAS*. DOI: 10.1073/pnas.2501017122
3. Ying Wang, **Yaguang Zhu,** Xiaobing Zuo, Lilin He, and Young-Shin Jun. Soft Nanoconfinement Nucleates and Stabilizes Ultrasmall Amorphous Calcium Carbonate from Aggregation. *Crystal Growth & Design.* DOI: 10.1021/acs.cgd.4c01555
4. Ping I Chou, Xuanhao Wu, Zhenwei Gao, **Yaguang Zhu**, and Young-Shin Jun. Bicarbonate Concentrations Affect Arsenic Release from Arsenopyrite and Nanoscale Iron (III)(Hydr) oxide Formation: Importance of Unconfined Aquifer Carbonate Chemistry (2025). *Environmental Science: Nano*. DOI: 10.1039/D4EN00805G
5. **Yaguang Zhu**, Prashant Gupta, Hamed Gholami Derami, Srikanth Singamaneni, and Young-Shin Jun. Chemical Functional Groups Regulate Ion Concentrations and pHs in Nanopores (2025). *ACS Applied Materials & Interfaces*. DOI: 10.1021/acsami.4c15940
6. **Yaguang Zhu**, Lolya McWest, Carl I. Steefel, Qingyun Li, Zhenwei Gao, Jiumei Yang, and Young-Shin Jun, Sulfate Promotes Compact $CaCO_3$ Formation and Protects Portland Cement from

Supercritical CO_2 Attack (2025). *Environmental Science & Technology.* DOI: 10.1021/acs.est.4c08259

7. Kimberly Ventura-Martinez, **Yaguang Zhu**, Austin Booth, and Kelsey B. Hatzell. Impact of Asymmetric Microstructure on Ion Transport in $Ti_3C_2T_x$ Membranes (2024). *Nano Letters*. DOI: 10.1021/acs.nanolett.4c03080
8. **Yaguang Zhu**, Ying Wang, Zhenwei Gao, Prashant Gupta, Srikanth Singamaneni, Xiaobing Zuo, and Young-Shin Jun. *In Situ* Monitoring the Nucleation and Growth of Nanoscale $CaCO_3$ at the Oil–Water Interface (2024) *ACS Nano*. DOI: 10.1021/acsnano.4c02490
9. Ying Wang, **Yaguang Zhu**, Prashant Gupta; Singamaneni Srikanth; Byeongdu Lee; Young-Shin Jun. The Roles of the Oil -Water Interface in Forming Ultra-Small $CaSO_4$ Nanoparticles (2024). *ACS Applied Materials & Interface*. DOI: 10.1021/acsami.4c02256
10. **Yaguang Zhu**, Austin Booth, and Kelsey B. Hatzell. Confinement Effects on Moisture-Swing Direct Air Capture. *Environmental Science & Technology Letters* 11.2 (2024). DOI: 10.1021/acs.estlett.3c00712
11. Zhenwei Gao, Ping-I. Chou, Byeongdu Lee, **Yaguang Zhu**, Deoukchen Ghim, and Young-Shin Jun. Effects of Sodium and Magnesium Ions on the Photochemically Induced Heterogeneous Formation of Manganese Oxides and Their Structural Evolution (2023). *The Journal of Physical Chemistry C*. DOI: 10.1021/acs.jpcc.3c00644
12. **Yaguang Zhu**, Guangcheng Wang, and Young-Shin Jun. Supercritical Carbon Dioxide/Nitrogen/Air Extraction with Multistage Stripping Enables Selective Recovery of Rare Earth Elements from Coal Fly Ashes (2023). *RSC Sustainability.* DOI: 10.1039/D2SU00033D
13. Zhenwei Gao; Ping-I Chou; Jing Liu; **Yaguang Zhu**, and Young-Shin Jun. Oxidative Roles of Polystyrene Based Nanoplastics in Inducing Manganese Oxide Formation under Light Illumination. (2022) *ACS Nano.* DOI:10.1021/acsnano.2c05803
14. **Yaguang Zhu**, Hamed Gholami Derami, Prashant Gupta, Rohit Gupta, Srikanth Singamaneni, and Young-Shin Jun. Ionic surface propensity controls pH in nanopores. (2022) *Chem*. DOI:10.1016/j.chempr.2022.07.021
15. Zhenwei Gao, Jing Liu; Charlie Skurie, **Yaguang Zhu**, and Young-Shin Jun. Photochemical Reactions of Dissolved Organic Matter and Bromide Ions Facilitate Abiotic Formation of Manganese Oxides.(2022) *Water Research*, 222, 118831. DOI: 10.1016/j.watres.2022.118831
16. **Yaguang Zhu**, Zhenwei Gao, Byeongdu Lee, and Young-Shin Jun. Process-Specific Effects of Sulfate on $CaCO_3$ Formation in Environmentally Relevant Systems. (2022) *Environmental Science & Technology*, 56(12), 9063–9074. DOI: 10.1021/acs.est.1c08898
17. Eugene Kim, Juya Jeon, **Yaguang Zhu**, Ethan D. Hoppe, Young-Shin Jun, Guy M. Genin, and Fuzhong Zhang. (2021) A Biosynthetic Hybrid Spidroin-Amyloid-Mussel Foot Protein for Underwater Adhesion on Diverse Surfaces. *ACS Applied Materials & Interfaces*, 13 (41), 48457-48468. DOI: 10.1021/acsami.1c14182
18. Young-Shin Jun, **Yaguang Zhu**, Ying Wang, Deoukchen Ghim, Xuanhao Wu, Doyoon Kim, and Haesung Jung. Classical and Nonclassical Nucleation and Growth Mechanisms for Understanding Nanoparticle Formation, *Annual Review of Physical Chemistry*, 73, 453-477. DOI: 10.1146/annurev-physchem-082720-100947

19. Cao, Sisi, Xuanhao Wu, **Yaguang Zhu**, Prashant Gupta, Adrian Martinez, Yunzhu Zhang, Deoukchen Ghim et al. (2021) MXene Aerogel for Efficient Photothermally-Driven Membrane Distillation with Dual-Mode Antimicrobial Capability. *Journal of Materials Chemistry A*, 9, 22585-22596. DOI: 10.1039/D1TA05058C
20. **Yaguang Zhu**, Qingyun Li, Doyoon Kim, Yujia Min, Byeongdu Lee, and Young-Shin Jun. (2021) Sulfate-Controlled Heterogeneous $CaCO_3$ Nucleation and Its Non-linear Interfacial Energy Evolution. *Environmental Science & Technology*, 55, 16, 11455–11464. DOI:10.1021/acs.est.1c02865
21. Christopher H. Bowen, Cameron J. Sargent, Ao Wang, **Yaguang Zhu**, Xinyuan Chang, Jingyao Li, Xinyue Mu, Jonathan Galazka, Young-Shin Jun, Sinan Keten, and Fuzhong Zhang. (2021) Microbial production of megadalton titin yields fibers with advantageous mechanical properties. *Nature Communications*, 12(1), 1-12. DOI:10.1038/s41467-021-25360-6
22. Li, Jingyao, **Yaguang Zhu**, Han Yu, Bin Dai, Young-Shin Jun, and Fuzhong Zhang. (2021). Microbially Synthesized Polymeric Amyloid Fiber Promotes β-Nanocrystal Formation and Displays Gigapascal Tensile Strength. *ACS nano*, 15(7), 11843-11853. DOI: 10.1021/acsnano.1c02944
23. Cao, Sisi, Xuanhao Wu, **Yaguang Zhu**, Rohit Gupta, Albern Tan, Zhongyang Wang, Young-Shin Jun, and Srikanth Singamaneni. (2020). Polydopamine/hydroxyapatite nanowire-based bilayered membrane for photothermal-driven membrane distillation. *Journal of Materials Chemistry A*, 8(10), 5147-5156. DOI: 10.1039/C9TA12703H
24. Lijie Zhang, **Yaguang Zhu**, Xuanhao Wu, and Young-Shin Jun. (2019). Effects of sulfate on biotite interfacial reactions under high temperature and high CO_2 pressure. *Physical Chemistry Chemical Physics*, 21(12), 6381-6390. DOI: 10.1039/C8CP07368F
25. Hong-Bo Li, Meng-Ya Li, Di Zhao, **Ya-Guang Zhu**, Jie Li, Albert L. Juhasz, Xin-Yi Cui, Jun Luo, and Lena Q. Ma. (2018). Food influence on lead relative bioavailability in contaminated soils: Mechanisms and health implications. *Journal of Hazardous Materials*, 358, 427-433. DOI: 10.1016/j.jhazmat.2018.06.034
26. Hong-Bo Li, Jie Li, **Ya-Guang Zhu**, Albert L. Juhasz, and Lena Q. Ma. (2015). Comparison of arsenic bioaccessibility in housedust and contaminated soil based on four assays. *Science of the Total Environment*. DOI:10.1016/j.scitotenv.2015.06.060.

Manuscripts in Review

27. **Yaguang Zhu**, Hakhyeon Song, Anush Venkataraman, Olivia Vulpin, Claudio A. Ruiz Torres, Hanwoong Kim, Po-Wei Huang, Zhuo Li, Michael Drakopoulos, Nghia T. Vo, Zhong Zhong, Shannon Boettcher, Sankar Nair, Marta C. Hatzell, and Kelsey B. Hatzell. Visualization of Coupled Dynamics of Water, Gas, and Salt in Bicarbonate Electrolysis. *Under Review*

PATENT

1. Young-Shin Jun and **Yaguang Zhu.** *Supercritical Fluid-Enhanced Selective Extraction of Rare Earth Elements*. Publication number: 20230249100

2. Kelsey B. Hatzell, **Yaguang Zhu**, and Austin Booth. *Mixed-Anion Sorbent for Dual-Functional Moisture-Swing Direct Air Capture of Carbon Dioxide and Ambient Water Harvesting.* Submitted. Application number: 63/723,800

PROPOSAL PREPARATION EXPERIENCE

Funding proposals

1. Contributing author to a proposal to the Climate and Energy Grand Challenge Award from the High Meadows Environmental Institute, funded in 2025. "*Electro-Biochemical Process to Convert CO_2 into Plastic Monomer*".
2. Author of a proposal for a Mistletoe Research Fellowship, a $10,000 independent research fund, from the Momental Foundation, awarded in 2022 (32 awardees from 430 candidates). "*Mechanistic Insights into Interfacial Control of Carbon Capture and Utilization*".
3. Contributing author to a proposal to the Petroleum Research Fund of the American Chemical Society, funded in 2021. "*Probing Calcium-containing Nanoparticle Nucleation in Situ at Dynamic Oil-Brine Interfaces*".
4. Contributing author to a proposal to Consortium for Clean Coal Utilization, funded in 2020. "*Novel Liquid Phase Extraction and Separation Processes for Recovering Rare Earth Elements from Coal Fly Ash*".

Synchrotron X-ray beamline and Neutron beamline proposals

1. Contributing author for GUP-57533, Beamline 11-ID-B, Advanced Photon Source, Argonne National Laboratory. "*Phase transformation of calcium bearing minerals, from amorphous to crystalline, in the confined structure*".
2. Contributing author for GUP-59253, Beamline 12-ID-B, Advanced Photon Source, Argonne National Laboratory. "*In situ investigations of the effects of nano-confinement on calcium carbonate nucleation in size-controlled pores*".
3. Contributing author for GUP-59263, Beamline 11-ID-B, Advanced Photon Source, Argonne National Laboratory. "*Nano-confinement effects on the phase transformation of calcium bearing minerals*".
4. Contributing author for GUP-60535, Beamline 11-ID-B, Advanced Photon Source, Argonne National Laboratory. "*The effects of nanoscale confinement on the phase evolution kinetics and polymorphs of calcium bearing minerals*".
5. Contributing author for GUP-63096, Beamline 11-ID-B, Advanced Photon Source, Argonne National Laboratory. "*Analyses of the amorphous $Ca(CO_3)_x(SO_4)_{1-x} \cdot nH_2O$ ($0 \leq x \leq 1$) structure and its phase transformation*".
6. Contributing author for GUP-65525, Beamline 13-ID-E, Advanced Photon Source, Argonne National Laboratory. "*Investigation of the distribution and speciation of rare earth elements in coal-based materials by μ-XRF and μ-XANES*".

7. Contributing author for GUP-65526, Beamline 12-ID-B, Advanced Photon Source, Argonne National Laboratory. "*Investigate $CaCO_3$ nanoparticle formation and aggregation at an oil–water interface using small-angle X-ray scattering*".
8. Contributing author for GUP-6552, Beamline 11-ID-B, Advanced Photon Source, Argonne National Laboratory. "*Phase Analyses of CaCO3 formed at oil–water interfaces*".
9. Contributing author for GUP-68992, Beamline 14-BM-C, Advanced Photon Source, Argonne National Laboratory. "*Study of Molecular Structure of Spider Silk-Amyloid Hybrid Protein Based Fiber Materials*".
10. Contributing author for proposal 27878.1, Oak Ridge National Laboratory, General-Purpose Small-Angle Neutron Scattering Diffractometer, Title is "*In situ detection of nanosized $CaCO_3$ nucleation in reverse micelles*".

PRESENTATIONS

1. **Yaguang Zhu**, Qinsi Xiong, WooCheol Jeon, Monika Blum, Fernando Camino, George Schatz, and Kelsey B. Hatzell. Water modulates ion transport through two-dimensional titanium carbide membrane. MRS Fall meeting, Boston, Nov 30 – Dec 5, 2025
2. **Yaguang Zhu,** Qinxi Xiong. More than a spectator: Critical Roles of water in ion transport through 2D membrane. 2025 EFRC-Hub-CMS-CCS PI meeting, Team Science Contest, Bethesda, August 11-12, 2025
3. **Yaguang Zhu** and Kelsey Hatzell. A chaotropic ion mediated effective ion sieving with two-dimensional titanium carbide membrane. 2024 Spring ACS National Meeting & Exposition, New Orleans, March 16-21, 2024.
4. **Yaguang Zhu**, Austin Booth, and Kelsey Hatzell. Understanding the critical role of anions in polymeric ion exchange resin for moisture-swing CO_2 capture. 2024 Spring ACS National Meeting & Exposition, New Orleans, March 16-21, 2024.
5. **Yaguang Zhu (invited).** Preparing beamtime proposals for your research. Materials Imaging Workshop, Princeton University. November 3rd, 2024.
6. **Yaguang Zhu**, Zhenwei Gao, Prashant Gupta, Srikanth Singamaneni, Xiaobing Zuo, and Young-Shin Jun. Uncovering the formation and phase transformation of calcium carbonate nanoparticle near the oil–water interface with X-ray scattering techniques. 2023 Fall ACS National Meeting & Exposition, San Franscico, August 13-17, 2023
7. **Yaguang Zhu (invited**), Understanding the Critical Role of Anions in Moisture-swing CO_2 capture, New Light: Rising Stars in Energy and the Environment. Andlinger Center 2023 Summer Seminar Series, Princeton University, July 12, 2023**.**
8. **Yaguang Zhu**, Prashant Gupta, Srikanth Singamaneni, and Young-Shin Jun. Chemical functional groups determine pH and concentrations of toxic ions in the nanoporous system. 2023 AEESP Research and Education Conference, Boston, June 20-23, 2023

9. **Yaguang Zhu**, Prashant Gupta, Srikanth Singamaneni, and Young-Shin Jun. Hydrophilicity/hydrophobicity controls pH and concentrations of heavy metals in nanopores. 2022 Spring ACS National Meeting & Exposition, San Diego, March 20-24, 2022.
10. **Yaguang Zhu**, Guangcheng Wang, and Young-Shin Jun. Supercritical Fluid Extraction with Multistage Stripping for Selective Recovery of Rare Earth Elements from Coal Fly Ashes. 2022 Spring ACS National Meeting & Exposition, San Diego, March 20-24, 2022.
11. **Yaguang Zhu,** Zhenwei Gao, Prashant Gupta, Srikanth Singamaneni, Byeongdu Lee, and Young-Shin Jun. Nucleation and phase transformation of calcium carbonate near the oil–water interface. 2022 Spring ACS National Meeting & Exposition, San Diego, March 20-24, 2022.
12. **Yaguang Zhu**, Hamed Gholami Derami, Prashant Gupta, Rohit Gupta, Srikanth Singamaneni, and Young-Shin Jun. Solution pH in nanopores is controlled by ionic surface propensities. 261st ACS National Meeting, April 5-16, 2021.
13. **Yaguang Zhu**, Zhenwei Gao, Byeongdu Lee, and Young-Shin Jun. Roles of sulfate in the nucleation, growth, and Ostwald ripening of $CaCO_3$ on quartz., 261st ACS National Meeting, April 5-16, 2021.
14. **Yaguang Zhu,** Lolya McWest, Carl I. Steefel, Qingyun Li, Jiumei Yang, Zhenwei Gao, and Young-Shin Jun. Sulfate Ions Chemically and Mechanically Protects the Portland Cement during Supercritical CO_2 Attack: Implications for Geologic Carbon Sequestration. The 2020 American Geophysical Union (AGU) Fall Meeting, December 7-11, 2020.
15. **Yaguang Zhu**, Byeongdu Lee, and Young-Shin Jun, Sulfate decreases the nucleation rate of $CaCO_3$ and increases its growth rate on quartz. 260th ACS National Meeting, August 17-20, 2020. **Selected for a Certificate of Merit in the Division of Environmental Chemistry.**
16. **Yaguang Zhu**, Lolya McWest, Carl I. Steefel, Qingyun Li, Jiumei Yang, Zhenwei Gao, and Young-Shin Jun. Sulfate induces a compact and thick $CaCO_3$ formation that helps protect Portland cement from supercritical CO_2 attack. 260th ACS National Meeting, August 17-20, 2020.
17. **Yaguang Zhu**, Qingyun Li, Doyoon Kim, Yujia Min, Byeongdu Lee and Young-Shin Jun. Decreased nucleation rate and nucleus crystallinity of $CaCO_3$ on quartz with sulfate incorporation. 257th ACS National Meeting, Orlando, March 31-April 4, 2019. **Selected for a Student Travel Award by the Division of Geochemistry.**

TEACHING AND MENTORING EXPERIENCE

Teaching Assistant

1. Course: EECE 112 Earth's Future: Causes & Consequences of Global Climate Change, 2018 Fall. Responsibilities: offered biweekly help sessions, graded exams, and attended weekly TA meetings.
2. Course: EECE 424 Digital Process Control, 2018 Spring, Responsibilities: helped students with the experiments, graded assignments and exams, and offered weekly office hours.
3. Course: EECE 203 Thermodynamics I in EECE, 2017 Fall. Responsibilities: graded 12 assignments for 40 undergraduate students, graded exams, offered weekly help sessions, and offered weekly office hours.

Student Mentoring

1. **Ms. Lolya McWest** from Rutgers University, undergraduate student, Washington University Summer Engineering Fellowship (WUSEF) Program, 2019 summer.
2. **Ms. Jiumei Yang,** masters student, Independent study in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2019 Fall.
3. **Mr. Guangcheng Wang**, masters student, Independent study in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2019 Fall and Spring.
4. **Mr. Junyan Liu**, masters student, Independent study in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2019 Spring.
5. **Ms. Wanqing Zeng**, masters student, Independent study in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2020 Spring.
6. **Mr. Jianshang Li**, masters student, Independent study in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2020 Spring.
7. **Ms. Minkyoung Jung**, first year doctoral student, Rotation in the Department of Energy, Environmental and Chemical Engineering at Washington University in St. Louis, 2021 Fall.
8. **Mr. Austin J. Booth**, first year doctoral student, Rotation in the Department of Chemical and Biological Engineering at Princeton University, 2023 Spring
9. **Ms. Kimberly C. Ventura-Martinez**, first year doctoral student, Rotation in the Department of Chemistry at Princeton University, 2023 Spring
10. **Mr. Ethan H. Lam**, senior undergraduate student, thesis project in the Department of Mechanical and Aerospace Engineering at Princeton University (selected as finalist for the thesis award), 2023 Spring
11. **Mr. Timothy Kopec**, senior undergraduate student, thesis project in the Department of Mechanical and Aerospace Engineering at Princeton University (finalist for the thesis award), 2023 Spring
12. **Mr. Justin Smallwood**, first year undergraduate student, summer internship in the Department of Mechanical and Aerospace Engineering at Princeton University, 2023 Summer

OUTREACH PROGRAMS

1. Graduate student instructor, "Introduction to Environmental Challenges and Environmental Engineering", for black middle school students from the BrightPath STEAM Academy (https://brightpathsteam.org/), October 16, 2021.
2. Graduate student instructor, "Moving and Shaking: An Introduction to Engineering" for students in grades 6-8 (middle school), supported by the St. Louis Area Gifted Resource Council, October-November, 2017, 2018, 2019, St. Louis, MO, USA.
3. Graduate student instructor, offering hands-on workshops for more than 100 female high school students in 2017 & 2018 "Women in STEM Event"

PROFESSIONAL SERVICE

Journal reviewer (listed alphabetically)

- ACS Applied Materials & Interfaces
- ACS EST Water
- ACS Omega
- ACS Sustainable Chemistry & Engineering
- Chemical Engineering Journal
- Critical Reviews in Environmental Science and Technology
- Environmental Science & Technology
- RSC Sustainability

Beamtime and national lab resource proposal reviewer

- Center for Functional Nanomaterials, Brookhaven National Laboratory