ZHE ZHOU

Suite 3000, Science and Engineering Hall, 800 22nd St NW, Washington, DC 20052
Department of Civil and Environmental Engineering · The George Washington University
Email: zhou0530@gwu.edu · Google Scholar

PROFESSIONAL

2019—Present Graduate Research Assistant, **The George Washington University**
Department of Civil and Environmental Engineering

EDUCATION

2019—Present **The George Washington University**, USA
Ph.D. in Environmental Engineering
- Advisor: Danmeng Shuai

2019 **The George Washington University**, USA
M.Sc. in Environmental Engineering

2017 **Dalian University of Technology**, P.R. China
B.E. in Environmental Engineering

HONORS AND AWARDS

Chemical Society of Washington (CSW) Student Travel Award for ACS Spring 2022 meeting.

Outstanding Graduate Award, Dalian University of Technology, P.R. China, 2017.

Academic Excellence Awards, Dalian University of Technology, P.R. China, 2013—2017.

PUBLICATIONS

6. **Zhou, Z.**, Shuai, D. Materials "Making" Microorganisms Different: Microbe-Material Crosstalk Facilitating Pathogen Disinfection and Driving Pathogen Evolution. 2023. *In Preparation*

5. **Zhou, Z.**, Li, M., Zhang, Y., Kong, L., Smith, V. F., Zhang, M., Gulbrandson, A. J., Waller, G. H., Lin, F., Liu, X., Durkin, D. P., Chen, H., Shuai, D. Fe—Fe Double-Atom Catalysts for Murine Coronavirus Disinfection: Nonradical Activation of Peroxides and Mechanisms of Virus Inactivation. *Environ. Sci. Technol*. 2023, 57, 9, 3804—3816.

4. Antwi Boasiako, C., **Zhou, Z.**, Huo, X., Ye, T. Development of Pd-based Catalysts for Hydrogenation of Nitrite and Nitrate in Water: A Review. *J. Hazard. Mater.* 2023, 446, 130661.

3. Shen, H., † **Zhou, Z.,** † Wang, H., † Chen, J., Zhang, M., Han, M., Shen, Y., Shuai, D. Photosensitized Electrospun Nanofibrous Filters for Capturing and Killing Airborne Coronaviruses under Visible Light Irradiation. *Environ. Sci. Technol.* 2022, 56, 7, 4295—4304. **(† Co-first Author)**

2. **Zhou, Z.**, Li, M., Kuai, C., Zhang, Y., Smith, V. F., Lin, F., Aiello, A., Durkin, D. P., Chen, H., Shuai, D. Fe-based Single-Atom Catalysis for Oxidizing Contaminants of Emerging Concern by Activating Peroxides. *J. Hazard. Mater.* 2021, 418, 126294.

1. Shen, H., † **Zhou, Z.,** † Wang, H., † Zhang, M., Han, M., Durkin, D. P., Shuai, D., Shen, Y. Development of Electrospun Nanofibrous Filters for Controlling Coronavirus Aerosols. *Environ. Sci. Technol. Lett.* 2021, 8, 7, 545—550. **(† Co-first Author)**

CONFERENCE PRESENTATIONS

4. **Zhou, Z.**, Li, M., Zhang, Y., Kong, L., Smith, V. F., Zhang, M., Gulbrandson, A. J., Waller, G. H., Lin, F., Liu, X., Chen, H., Durkin, D. P., Shuai, D. Activating Peroxymonosulfate for Disinfecting Coronaviruses by Double-Atom Catalysis, ACS Spring Meeting, San Diego, CA, USA, 03/2022. ORAL

3. **Zhou, Z.**, Shen, H., Wang, H., Chen, J., Zhang, M., Han, M., Shen, Y., Shuai, D. Photosensitized Electrospun Nanofibrous Filters for Capturing and Killing Airborne Coronaviruses under Visible Light Irradiation, ACS Fall Meeting, Atlanta, GA, USA, 08/2021. ORAL

2. **Zhou, Z.**, Li, M., Kuai, C., Zhang, Y., Smith, V. F., Lin, F., Aiello, A., Durkin, D. P., Chen, H., Shuai, D. Single-Atom Catalysis for Oxidizing Contaminants of Emerging Concern via High-Valent Fe Species, 95th ACS Colloid and Surface Science Symposium (virtual), USA, 06/2021. ORAL

1. **Zhou, Z.**, Li, M., Kuai, C., Zhang, Y., Smith, V. F., Lin, F., Aiello, A., Durkin, D. P., Chen, H., Shuai, D. Rational Design of a Single-Atom Catalyst for Oxidizing Contaminants of Emerging Concern via High-Valent Fe Species, ACS Spring Meeting (virtual), USA, 04/2021. POSTER

RESEARCH EXPERIENCE

Graduate Research Assistant

Department of Civil and Environmental Engineering, The George Washington University

2019—Present

Development of heterogeneous single- and double-atom catalysts for oxygen activation in controlling the transmission of pathogenic microorganisms, *09/2022—Present.*

- Objective: To prepare heterogeneous single- and double-atom catalysts displaying oxidase-like activity that oxygen will be activated to produce reactive oxygen species (e.g., superoxide anion radical and singlet oxygen) for inactivating a wide variety of environmental pathogens.

Sunlight-mediated inactivation of free murine norovirus and vesicle-cloaked murine norovirus in the presence of exogenous photosensitizes, *04/2021—Present*.

- Objective: To understand the exogenous damages caused by photoactivation of natural organic matter on two types of virion-related particles of murine noroviruses (i.e., stand-alone viral particles and virus clusters inside vesicles) in natural water system.
- Singlet oxygen and the excited triplet states of dissolved organic matter (^{3}DOM*****) are the dominant species photochemically produced from Suwannee River humic acid under sunlight irradiation (320 nm—visible light).

Photosensitized electrospun nanofibrous filters for murine coronavirus aerosol filtration and inactivation under visible light irradiation, *10/2020—01/2022*.

- Collaborated with Dr. David P. Durkin on electrospun filter characterization; collaborated with industrial partners for aerosol size distribution characterization and scaling-up synthesis and commercialization of the photosensitized electronspun filters.
- Objective: To fabricate photosensitized electronspun nanofibrous filters for capturing murine-coronavirus-laden aerosols and inactivating the captured viruses on the filters simultaneously under indoor light irradiation to enable filter disinfection and reuse.

- Photosensitized electronspun nanofibrous filters were prepared by incorporating visible-light-responsive dyes (i.e., rose bengal, methylene blue, crystal violet, riboflavin, and toluidine blue O) into polymer solutions for electrospinning.
- Photosensitized electrospun nanofibrous filters can physically capture > 99 % of murine-coronavirus-laden aerosols (dominant aerosol size of 400−600 nm) and chemically inactivate > 97% of the captured viruses by singlet oxygen attack after desk lamp illumination for only 15 min.

Fe−Fe double-atom catalysis activating peroxymonosulfate (PMS) for murine coronavirus inactivation in diverse environmental matrices, *07/2020−10/2022*.

- Collaborated with Drs. Feng Lin, Hanning Chen, and David P. Durkin on Fe single-atom catalyst and Fe−Fe double-atom catalyst characterization; collaborated with Dr. Nihal Altan-Bonnet on murine coronavirus infectivity study.
- Objective: To explore the synergistic effect of atomically dispersed Fe−Fe dual-atom sites on double-atom catalysts in activating PMS to enhance the disinfection potency of PMS for murine coronavirus control.
- Synthesized and characterized Fe single-atom catalysts and Fe−Fe double-atom catalysts on pristine and sulfur-doped graphitic carbon nitride.
- Fe−Fe double-atom catalysis outperforms Fe single-atom catalysis by facilitating catalyst-mediated electron transfer from organic substrates to PMS for advancing oxidation.
- PMS treatment damages murine coronavirus proteins and genomes, which impedes virus internalization into host cells and further genome replication, and Fe−Fe double-atom catalyst-activated PMS treatment enhances these damages.

Fe single-atom catalysis activating peroxides for emerging contaminant degradation in water and wastewater treatment, *08/2019−05/2021*.

- Collaborated with Drs. Feng Lin, David P. Durkin, and Sebastian A. Stoian on single-atom catalyst characterization; collaborated with Dr. Hanning Chen on molecular simulations.
- Objective: To study the electronic structure of Fe atoms on Fe single-atom catalysts to advance peroxide activation kinetics and catalytic performance.
- Synthesized and characterized Fe single-atom catalyst on oxygen-doped nitrogen-functionalized carbon support.
- Chemical properties of peroxides and the bonding environment of Fe atoms on Fe single-atom catalysts determines the kinetics and mechanisms of peroxide activation and selectivity of catalysis for emerging contaminant oxidation.
- The introduction of oxygen dopants to Fe single-atom catalysts tailors the structure of Fe atoms from $Fe-N_4$ to $Fe-N_x-O_{4-x}$ (x = 2 and 3) which facilitates their capacity to donate electrons then forming high-valent Fe species to advance oxidation upon peroxide activation.

TEACHING EXPERIENCE

Teaching assistant for Aquatic Chemistry, The George Washington University, *08/2022−12/2022*.

- Guest lectured one class about acid-based chemistry.
- Graded homework.

Grader for Environmental Engineering: Water Resources and Water Quality, The George Washington University, *01/2022−05/2022*.

Guest teaching assistant for Environmental Engineering Lab, University of California, Riverside, *02/2021*.

- Guest lectured one class about photodegradation and photocatalysis.
- Assisted with lab experimental design and preliminary data demonstration.

Grader for Environmental Engineering: Water Resources and Water Quality, The George Washington University, *01/2020—05/2020*.

PROFESSIONAL SERVICE

Journal reviewer. *2021—Present*.

- Applied Catalysis B: Environmental
- Journal of Hazardous Materials

LABORATORY AND RESEARCH SKILLS

Instruments

- Scanning electron microscopy (SEM)
- Confocal laser scanning microscopy (CLSM)
- Ion chromatography (IC)
- High performance liquid chromatography (HPLC)
- Gas chromatography with mass spectrometry (GC-MS)
- Quantitative polymerase chain reaction (qPCR) machines
- NanoSight nanoparticle tracking analysis (NTA)

Experience

- Electrospinning
- Catalyst and nanomaterial fabrication and characterization
- Cell, bacteria, and virus culturing
- RNA extraction and quantification
- Purification and quantification of genomes, proteins, and lipids
- Enzyme-linked immunosorbent assays (ELISA)
- Chronoamperometry (CA) and electrochemical impedance spectroscopy (EIS) analysis

Software

- DigitalMicrograph (DM) and ImageJ for image analysis
- Athena for X-ray absorption near edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) data processing
- Artemis for EXAFS data fitting
- Python and MATLAB

Soft Skills

- Present research findings to audiences at several research group meetings, seminar talks, and national and international academic conferences.
- Give a few lectures to undergraduate and graduate students

LANGUAGES

English: proficient

Mandarin: native language

PROFESSIONAL AFFILIATIONS

Member of Association of Environmental Engineering and Science Professors

Member of American Chemical Society

Member of American Society for Microbiology