

Weixing Hao

Google Scholar: [Link](#) Website: [Link](#)

Tel: +1 - 573-202-1902

LinkedIn: www.linkedin.com/in/weixing-hao

E-mail: davidhao1994@gmail.com

Research Interests and Goals

Project Leadership: Leads **aerosol science** research from experimental design to data-driven insights.

Interdisciplinary Approach: Integrates **engineering, environmental science, and public health** to solve air quality challenges.

Aerosol Measurement: Advances **bioaerosol detection, particle characterization, and exposure assessment** for safer environments.

Health and Air Quality: Enhances **occupational air filtration, inhalation toxicology, and aerosol health research**.

Collaborative Research: Develops cross-disciplinary solutions for **aerosol mitigation and control**.

Education

| | |
|---|------------------|
| University of Miami | Miami, FL, USA |
| Ph.D. in Chemical, Environmental and Materials Engineering; | 8/2022 - present |
| Advisor: Yang Wang | |
| Dissertation: The Role of Aerosol Particle Size in the Dynamics and Control of Indoor Bioaerosols | |
| Missouri University of Science and Technology (transferred to the University of Miami) | Rolla, MO, USA |
| Ph.D. Candidate in Civil and Environmental Engineering; | 8/2019 - 8/2022 |
| University of Science and Technology Beijing | Beijing, China |
| M.E. in Metallurgical Engineering; | 9/2016 - 1/2019 |
| North China University of Science and Technology | Hebei, China |
| B.E. in Metallurgical Engineering; | 9/2012 - 7/2016 |

Academic & Research Experience

| | |
|---|-------------------|
| University of Miami | Miami, FL, USA |
| Graduate Research Assistant | 8/2019 – present |
| <ul style="list-style-type: none">• Led a bioaerosol viability study using bacterial culture techniques and qPCR molecular analysis, evaluating the effects of UV germicidal irradiation, ozone, relative humidity, and temperature, with a focus on size-dependent viability.• Investigated the filtration performance of 250+ non-medical materials during COVID-19, achieving N95-level efficiency with layered designs while maintaining breathability. Findings shaped public health guidelines and received 10+ media coverage (NYT, BBC, NPR).• Developed numerical models in COMSOL Multiphysics and MATLAB to optimize Condensation Particle Counters (CPC) performance for improving sub-3 nm detection accuracy for industrial and environmental monitoring.• Mentored 10+ undergraduate and master's students in research projects, fostering technical expertise and independent research skills.• Authored and presented 20+ research papers and conference presentations, demonstrating strong scientific communication skills.• Established and managed lab operations as a founding member, leading logistics, coordination, and relocation to a new institution. | |
| Graduate Teaching Assistant | 1/2020 - present |
| <ul style="list-style-type: none">• Assisted in 5 undergraduate and graduate courses (<i>ENV ENG 5662 - Air Pollution Control; ENV ENG 3603 - Chemical Fundamentals of Environmental Engineering; ENV ENG 2601 - Fundamentals of Environmental Engineering and Science; CET 340 - Introduction to Environmental Engineering; CET 541/641 - Environmental Engineering Microbiology</i>) handling grading, lab demonstrations, presentations, and one-on-one academic support, facilitating a deeper understanding of environmental engineering principles.• Developed strong communication and instructional skills, simplifying complex engineering concepts, encouraging active discussions, and fostering a collaborative learning environment. | |
| Pacific Northwest National Laboratory | Richland, WA, USA |
| Visiting Scholar | 10/2023 - 3/2024 |
| <ul style="list-style-type: none">• Awarded the competitive NSF INTERN Fellowship for research collaboration at PNNL.• Developed supervised Machine Learning models (Random Forest) to identify New Particle Formation (NPF) events with 90-95% accuracy.• Investigated key atmospheric variables affecting NPF, including solar radiation, relative humidity, and temperature.• Applied Partial Dependence Plots (PDPs) to uncover non-linear relationships between environmental variables and NPF, offering mechanistic insights for predictive modeling. | |

Publications

Patent

- **Hao, W.**, Huang, Y., Wang, Y. Simulated respiratory system and method,” No. 63/323,698, 2022.

Peer-Reviewed Journal Papers (11 Publications, 254 Citations)

1. **Hao, W.**, A. Parasch, S. Williams, J. Li, H. Ma, J. Burken, Y. Wang. 2020. Filtration performances of non-medical materials as candidates for manufacturing facemasks and respirators. *International Journal of Hygiene and Environmental Health* 229:113582. <https://doi.org/10.1016/j.ijheh.2020.113582>
2. **Hao, W.**, G. Xu, Y. Wang. 2021. Factors influencing the filtration performance of homemade face masks. *Journal of Occupational and Environmental Hygiene* 18:128-138. <https://doi.org/10.1080/15459624.2020.1868482> (The most cited articles published within the last 3 years)
3. **Hao, W.**, Stolzenburg, M., Attoui, M., Zhang, J., & Wang, Y. 2021. Optimizing the activation efficiency of sub-3 nm particles in a laminar flow condensation particle counter: Model simulation. *Journal of Aerosol Science*, 158, 105841. <https://doi.org/10.1016/j.jaerosci.2021.105841>
4. **Hao, W.**, Kapiamba, K. F., Abhayaratne, V., Usman, S., Huang, Y. W., & Wang, Y. 2022. A simulated respiratory system for secondhand smoke generation and characterization. *Inhalation Toxicology*, 1-11. <https://doi.org/10.1080/08958378.2022.2075493>
5. **Hao, W.**, F. Mei, S. Hering, S. Spielman, Y. Wang. 2023. Mapping the performance of a versatile water-based condensation particle counter (vWCPC) with numerical simulation and experimental study. *Atmospheric Measurement Techniques*, 16, 3973–3986. <https://doi.org/10.5194/amt-16-3973-2023>
6. **Hao, W.**, Huang, Y. W., & Wang, Y. 2023. Bioaerosol size as a potential determinant of airborne *E. coli* viability under ultraviolet germicidal irradiation and ozone disinfection. *Nanotechnology*, 35, 145702. <https://doi.org/10.1088/1361-6528/ad14b4>
7. Cheng, S., **Hao, W.**, Wang, Y., Wang, Y., & Yang, S. 2022. Commercial Janus Fabrics as Reusable Facemask Materials: A Balance of Water Repellency, Filtration Efficiency, Breathability, and Reusability. *ACS Applied Materials & Interfaces*, 14(28), 32579-32589. <https://doi.org/10.1021/acsami.2c09544>
8. Kapiamba, K., **Hao, W.**, Adom, S., Liu, W., Huang, Y., Wang, Y. 2022. Examining the metal contents in primary and secondhand aerosols released by electronic cigarettes. *Chemical Research in Toxicology*, 35, 954-962. <https://doi.org/10.1021/acs.chemrestox.1c00411>
9. Brooks, J. P., Lupfer, C., Yang, W., **Hao, W.**, & Kapiamba, K. F. 2022. The effect of hypochlorous acid on the filtration performance and bacterial decontamination of N95 filtering facemask respirators. *American Journal of Infection Control*, 1-5. <https://doi.org/10.1016/j.ajic.2022.07.013>
10. Li, Y., Peng, Z., Li, J., Wei, C., Liu, S., **Hao, W.**, ... & Wu, C. 2023. Wearable MXene-Graphene Sensing of Influenza and SARS-CoV-2 Virus in Air and Breath: From Lab to Clinic. *Advanced Materials Technologies*, 2201787. <https://doi.org/10.1002/admt.202201787>
11. Gonzalez, A., Aboubakr, H. A., Brockgreitens, J., **Hao, W.**, Wang, Y., Goyal, S. M., & Abbas, A. 2021. Durable nanocomposite face masks with high particulate filtration and rapid inactivation of coronaviruses. *Scientific Reports*, 11(1), 1-11. <http://doi.org/10.1038/s41598-021-03771-1> (Top 100 in Materials Science)

Academic Activities

Reviewer Activities of Journals: peer-reviewed 30+ publications across 10+ journals:

- *PLOS One*; *Scientific Report*; *Aerosol Science & Technology*; *Atmospheric Measurement Techniques*; *Planetary and Space Science*; *ACS Omega*; *Journal of Hazardous Materials*; *Journal of Aerosol Science*; *ACS Environment & Health*; *Frontiers of Environmental Science & Engineering*

Professional Membership:

- Member of the American Association for Aerosol Research (AAAR).
- Member of the Center for Aerosol Science and Technology (CAST) at the University of Miami.

Conference: technical oral and poster presentations:

Invited Talks

- 10/2023: UM-CEME Fall 2023 Graduate Seminar at the University of Miami - **Hao, W.**, Y. Wang. *Toward Cleaner Breathing: Research in Particulate Filtration and Bioaerosol Mitigation*.
- 4/2023: National Society of Black Engineers (NSBE) at the University of Miami - **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols*.

Oral Presentations

- 10/2024: 42nd AAAR Annual Conference - **Hao, W.**, Mehra, M., Chakraborty, T. C., Mei, F., & Wang, Y. *Employing Machine Learning for New Particle Formation Identification and Mechanistic Analysis: Insights from a Six-Year Observational Study in the Southern Great*

Plains.

- 10/2023: 41st AAAR Annual Conference - **Hao, W.**, F. Mei, S. Hering, S. Spielman, Y. Wang. *Mapping the Performance of a Versatile Water-based Condensation Particle Counter (vWCPC) with Numerical Simulation and Experimental Study.*
- 4/2023: Air Pollution Workshop at the University of Florida- **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 3/2023: 15th Graduate + Postdoctoral Research Symposium at the University of Miami - **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 10/2021: 39th AAAR Annual Conference - **Hao, W.**, Stolzenburg, M., Attoui, M., Zhang, J., & Wang, Y. *Optimizing the Activation Efficiency of Sub-3 nm Particles in Laminar Flow Condensation Particle Counters by Model Simulation.*
- 10/2021: 39th AAAR Annual Conference - **Hao, W.**, Kapiamba, K. F., Abhayaratne, V., Usman, S., Huang, Y. W., & Wang, Y. *A Simulated Respiratory System for Secondhand Smoke Generation and Characterization.*
- 10/2020: 25th MAEEC Annual Conference - **Hao, W.**, A. Parasch, S. Williams, J. Li, H. Ma, J. Burken, Y. Wang. *Filtration Performance of Common Non-Medical Materials Used in Homemade Face Coverings.*

Poster Presentations

- 1/2025: 3rd Center for Aerosol Science and Technology (CAST) workshop at the University of Miami - **Hao, W.**, Mehra, M., Chakraborty, T. C., Mei, F., & Wang, Y. *Employing Machine Learning for New Particle Formation Identification and Mechanistic Analysis: Insights from a Six-Year Observational Study in the Southern Great Plains.*
- 1/2024: 2nd Center for Aerosol Science and Technology (CAST) workshop at the University of Miami - **Hao, W.**, Mehra, M., Chakraborty, T. C., Mei, F., & Wang, Y. *Employing Machine Learning for New Particle Formation Identification and Mechanistic Analysis: Insights from a Six-Year Observational Study in the Southern Great Plains.*
- 3/2023: Research day at the College of Engineering at the University of Miami - **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 1/2023: 1st Center for Aerosol Science and Technology (CAST) workshop at the University of Miami - **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 10/2022: 40th AAAR Annual Conference - **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 03/2022: Center for Biomedical Research (CBR) Symposium, Missouri S&T, **Hao, W.**, Huang, Y. W., & Wang, Y. *Influence of UV Irradiation on the Size-dependent Survivability of E. Coli-containing Bioaerosols.*
- 10/2020: 38th AAAR Annual Conference - **Hao, W.**, A. Parasch, S. Williams, J. Li, H. Ma, J. Burken, Y. Wang. *Filtration Performance of Common Non-Medical Materials as Candidates for Homemade Face Mask Filters.*
- 10/2019: 24th MAEEC Annual Conference - **Hao, W.**, Stolzenburg, M., Attoui, M., Zhang, J., & Wang, Y. *Enhancing the Detection Efficiency of Sub-3 nm Aerosols with A Modified Condensation Particle Counter.*

Research Projects

Understanding the evolution and transport of indoor bioaerosols

9/2020 - present

- Investigated the **size-dependent bioaerosol viability** in indoor environments, analyzing the effects of **UV germicidal irradiation (UVGI), ozone, time decay, relative humidity, and temperature** on airborne pathogens in a **controlled bioaerosol generation system**.
- Evaluated pathogen viability within bioaerosols using a combination of **bacterial culture techniques** and **qPCR molecular analysis**.
- **Technologies Utilized:** Sioutas Cascade Impactor; Gelatin filter; SKC BioSampler; 6 Jet Refillable Collison Nebulizer; Bacterial culture methods; qPCR molecular science; Inductively Coupled Plasma Mass Spectrometry.

Filtration performances of household materials for facemasks

8/2019 - 10/2021

- Investigated the filtration performance of common household materials for use in **3D-printed respirators** and **DIY facemasks** during COVID-19.
- Determined the **key factors** influencing the filtration performance of homemade face masks.
- Evaluated the filtration efficiency and breathability of **250+** different non-medical and fabric materials and freely shared them with the public.
- Achieved **N95-level filtration efficiency** using multiple layers of household air filters without significant flow resistance increase.
- Recommended **optimal material combinations** (fibrous and fabric layers) to maximize aerosol filtration while maintaining comfort.
- Demonstrated that washing and drying did not significantly degrade filtration performance, supporting material **reusability**.
- Explored triboelectric charging to enhance filtration efficiency, though its transient nature limited long-term practicality.
- Featured in **10+** major media outlets, including the *New York Times*, *BBC News*, *NPR News*, etc.
- **Technologies Utilized:** Scanning Mobility Particle Sizer; Aerodynamic Particle Sizer; Condensation particle Counter; Constant Output Atomizer; Air

Model simulation of laminar flow Condensation Particle Counters (CPC)

8/2019 - 5/2023

- Simulated alcohol- and water-based CPCs using **COMSOL Multiphysics** and **MATLAB**, evaluating their performance under various operating conditions (temperature, flow rate, inlet pressure, and geometry).
- Examined **particle activation** and **droplet growth** dynamics, identifying conditions where droplet growth reduction impacts counting efficiency, especially in low-pressure environments.
- Offered insights beneficial for future adjustments and enhancements in CPCs tailored to sub-3 nm particle detection, especially for precise particle detection and atmospheric aerosol monitoring.
- **Technologies Utilized:** COMSOL Multiphysics Simulation Coupled with MATLAB.

Machine learning for New Particle Formation (NPF) identification and analysis

10/2023 - 10/2024

- Conducted a six-year observational study at the DOE Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site to analyze NPF events.
- Developed supervised Machine Learning models using **Random Forest classifiers** to identify NPF events with 90–95% accuracy.
- Investigated **key atmospheric variables** influencing NPF, including solar radiation, relative humidity, and temperature, with feature importance analysis highlighting solar radiation intensity as a primary driver.
- Analyzed **seasonal and diurnal patterns**, revealing NPF frequency peaks in winter and spring with minimal occurrence in summer.
- Utilized **Partial Dependence Plots (PDPs)** to explore the non-linear relationships between atmospheric variables and NPF, providing mechanistic insights into their impact.
- **Technologies Utilized:** Random Forest, Python (scikit-learn), MATLAB, Aerosol Data Analysis Tools.

Awards and Skills

- **Awards:**
 - Outstanding Graduate Student Research Award Nominee (2024) – University of Miami ([Link](#))
 - US Student Travel Grant (2023) – 41st Annual American Association for Aerosol Research Conference, Portland, Oregon
 - Graduate Student Travel Scholarship (2023) – University of Miami
 - Cover Feature – *Chemical Research in Toxicology* ([Link](#))
- **Selected Media coverage** on particle filtration during COVID-19:
 - *The New York Times*: [What's the Best Material for a Mask for Coronavirus?](#)
 - *BBC News*: [Why we should all be wearing face masks](#)
 - *NPR News*: [Adding A Nylon Stocking Layer Could Boost Protection From Cloth Masks, Study Finds](#)
 - *C&EN News*: [Scientists take a closer look at materials for homemade masks](#)
 - *Daily Herald*: [What makes for a good homemade face mask?](#)
- **Research Skills:** Experimental design; Statistical analysis; Data processing; Data normalization; Data visualization
- **Aerosol Instrumentation:** Scanning Mobility Particle Sizer (SMPS); Aerodynamic Particle Sizer (APS); Condensation particle Counter (CPC); Constant Output Atomizer; 6 Jet Refillable Collision Nebulizer; Air Sampling Cassette; Sioutas Cascade Impactor; SKC BioSampler
- **Characterization Technologies:** Scanning Electron Microscope (SEM); Quantitative Polymerase Chain Reaction (qPCR); Inductively Coupled Plasma Mass Spectrometry (ICP-MS); Bacterial Culture Methods
- **Computational Modeling:** COMSOL Multiphysics
- **Data Science & Development Tools:**
 - **Programming Languages:** Python; MATLAB
 - **Framework/Libraries:** NumPy; Scikit-learn; Pandas, etc.
 - **Algorithms:** Supervised machine learning; Random Forest
 - **Development Tools:** Google Colab; GitHub