Ziwen He

University of Minnesota Twin Cities (Professor Joseph A. Zasadzinski's lab)
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PROFESSIONAL PROFILE

I am an expert in interfacial physics of multiphase fluid flows, holding a Ph.D. in Mechanical Engineering with a specialization in microscale fluid mechanics and polymer rheology. My expertise encompasses confocal microscopy, interfacial fluid-fluid/solid interactions, non-Newtonian fluid characterization, particle image velocimetry (PIV), thin film coating, tensiometry, and lipid monolayer dynamics. I also have extensive hands-on experience with high-speed imaging, rheometry, and advanced optical techniques, including reflective interference microscopy (RIM), total internal reflection microscopy (TIRM), multiphoton confocal imaging, scanning electron microscopy (SEM), and Fourier transform infrared spectroscopy (FTIR).

EDUCATION

Ph.D. Mechanical Engineering — Dec 2023
Baylor University, Waco, TX

- Ph.D. research in fluid mechanics under direction of Dr. Min Y. Pack. Dissertation title: Air entrainment dynamics under droplets from Newtonian to non-Newtonian fluids and their applications.

M.S. Mechanical Engineering — Aug 2023
Baylor University, Waco, TX

B.S. Mechanical and Civil Engineering — May 2019
Florida Institute of Technology, Melbourne, FL

B.S. Mechanical Engineering — May 2017
Shijiazhuang TieDao University, Shijiazhuang, Hebei

EMPLOYMENT HISTORY

Post-doctoral Associate — Jan 2024 - Present
Department of Chemical Engineering and Materials Science
University of Minnesota Twin Cities, Minneapolis, MN
Advisor: Prof. Joseph A. Zasadzinski

- Investigated the interfacial and self-assembling properties of biological surfactants, including lipids and proteins, to elucidate their role in modulating surface tension in the human lung.
- Implemented two-dimensional shear and dilatational rheometers, integrated with fluorescence imaging techniques, to analyze the relationship between interfacial mechanics, composition, and morphology of lung surfactants, thereby contributing to the understanding of respiratory distress syndrome mechanisms.
- Explored the impact of inflammation-induced competition between serum proteins and lung surfactants at the air-alveoli interface, identifying the potential role of Laplace instability in causing lung dysfunction during respiratory distress, thus paving the way for targeted therapeutic interventions.
- Participated in budget discussions, collaborated with team members to draft grant proposals, and contributed to the development of funding strategies to support research initiatives.

Research Assistant/Lab Manager May 2021 - Dec 2023
Department of Mechanical Engineering
Baylor University, Waco, TX

- Utilized reflective interference microscopy (RIM) and total internal reflection microscopy (TIRM) to address the air entrainment issue during the coating process.
- Explored the role of viscoelasticity and volatility in drop wetting applications using optical and rheological tools.
- Published 11 manuscripts (4 as first author) in reputable peer-reviewed journals and presented research findings at academic conferences and seminars.
- Advised 1 graduate student and 6 undergraduate students on their research.
- Managed procurement of equipment and supplies, as well as lab equipment maintenance.

Teaching Assistant Sep 2020 - May 2021
Department of Mechanical Engineering
Baylor University, Waco, TX

- Conducted ANSYS Fluent lab sessions for the Fluid Mechanics course (ME 3321) over two semesters, guiding students in applied computational fluid dynamics and simulation techniques to enhance their understanding of theoretical concepts.

Graduate Assistant Aug 2019 - Aug 2020
Department of Mechanical Engineering
Baylor University, Waco, TX

REFEREED JOURNAL PUBLICATIONS

See also my google scholar page.

13. Tran, H., **He, Z.**, & Pack, M. Y. (2024). Microbubble entrainment on thin liquid films under drop impacts. *Journal of Colloid and Interface Science, 682*, 915-923.
12. **He, Z.**, Tran, H., & Pack, M. Y. (2024). Capillary wave-assisted collapse of non-Newtonian droplets. *Physics of Fluids, 36*(9).
11. Upoma, M. A., **He, Z.**, Tran, H., Sivells, T., Cyran, J. D., & Pack, M. Y. (2024). Effects of dye addition on the rheological properties of aqueous polymer solutions. *Langmuir, 40*(37), 19377-19387..
10. Pirdavari, P., Tran, H., **He, Z.**, & Pack, M. Y. (2024). Drainage-induced spontaneous film climbing in capillaries. *Physical Review Fluids*, 9(9), 094005.
9. Pirdavari, P., Pourfattah, F., Tran, H., Wang, L., **He, Z.**, & Pack, M. Y. (2024). Experimental and numerical study on the performance index of mixing for low aspect ratio serpentine microchannels. *Engineering Research Express*, 6(3), 035009.
8. Huang, B., Iasella, S., Rathi, M., Hassler, J., Ciutara, C., **He, Z.**, Morse, D., & Zasadzinski, J. A. (2024) New experiments and models to describe soluble surfactant adsorption above and below the critical micelle concentration. *Journal of Colloid and Interface Science, 677*, 557-568.

7. **He, Z.**, Upoma, M. A., & Pack, M. Y. (2023). Dual nature of volatility on drop wetting dynamics of acetone–isopropanol mixtures on ultrathin smooth oil films. *Physics of Fluids*, 35(1), 012115.
6. Tran, H., **He, Z.**, Pirdavari, P., & Pack, M. Y. (2023). Interplay of drop shedding Mechanisms on High Wettability Contrast Biphilic Stripe-Patterned Surfaces. *Langmuir, 39*(48), 17551-17559..
5. **He, Z.**, Tran, H., & Pack, M. Y. (2022). Air entrainment dynamics of aqueous polymeric droplets from dilute to semidilute unentangled regimes. *Physics of Fluids, 34*(11).
4. Tran, H., **He, Z.**, Sakakeeny, J., Ling, Y., & Pack, M. Y. (2022). Oscillation dynamics of drops on immiscible thin liquid films. *Langmuir*, 38(3), 1243-1251.
3. **He, Z.**, Tran, H., & Pack, M. Y. (2021). Drop bouncing dynamics on ultrathin films. *Langmuir*, 37(33), 10135-10142.
2. **He, Z.**, & Pack, M. Y. Drop imact of dissimilar fluids: a review. *Advances in Colloid and Interface Science*. (Under Preparation)
1. **He, Z.**, Haider, O., Zasadzinski, J. A., & Walker, M. L., Interfacial processing and characterization for control of interfacially-dominated soft materials using Microtensiometer platform. *Advances in Colloid and Interface Science*. (Under Preparation)

CONFERENCE PRESENTATIONS

19. **He Z.**, Tran H., & Pack M.Y., "The Determination of the Critical Concentrations of Aqueous Polymeric Solutions Using the Fingerprint of Impacting Drops", AIChE Annual Meeting, San Diego, CA, 2024.
18. Pirdavari, P., Tran H., **He Z.**, & Pack M.Y., "Spontaneous Climbing of Thin Films Due to Drainage-Induced Surfactant Marangoni Effect", AIChE Annual Meeting, San Diego, CA, 2024.
17. **He Z.**, Tran H., & Pack M.Y., "Central collapse of non-Newtonian droplets", American Physical Society, Division of Fluid Dynamics (DFD), Washington, DC, 2023.
16. **He Z.**, Tran H., & Pack M.Y., "Collapse of non-Newtonian droplets", Bluebonnet Symposium. SMU, Dallas, TX, 2023.
15. **He Z.**, Tran H., & Pack M.Y., "Air entrainment dynamics under bouncing Boger droplets", American Physical Society, Division of Fluid Dynamics (DFD), Indianapolis, IN, 2022.
14. Tran H., **He Z.**, & Pack M.Y., "The interplay of dropwise condensation and drop shedding mechanism on biphilic patterned surfaces", American Physical Society, Division of Fluid Dynamics (DFD), Indianapolis, IN, 2022.
13. **He Z.**, Tran H., & Pack M.Y., "Air entrainment dynamics under xanthan gum droplets from dilute to semi-dilute regimes", American Chemical Society, Colloid & Surface Science Symposium, Golden, CO, 2022.
12. Tran H., **He Z.**, & Pack M.Y., "Dropwise condensation on biphilic patterned surfaces with multiple thermal conductivities", American Chemical Society, Colloid & Surface Science Symposium, Golden, CO, 2022.
11. **He Z.**, Tran H., & Pack M.Y., " Air entrainment dynamics under xanthan gum droplets". Bluebonnet Symposium. University of Texas at Dallas, Dallas, TX, 2022.

10. Li J., **He Z.**, & Pack M., "Mesler entrainment-like microbubble entrainment on immiscible thin liquid films", American Physical Society, Division of Fluid Dynamics (DFD), Phoenix, AZ, 2021.
9. Tran H., **He Z.**, & Pack M., "Drop oscillation dynamics on viscous thin immiscible liquid films: slip to pin transitions", American Physical Society, Division of Fluid Dynamics (DFD), Phoenix, AZ, 2021.
8. Felton O., **He Z.**, & Pack M., "How does relative humidity affect the way water droplets interact with a surface?", American Physical Society, Division of Fluid Dynamics (DFD), Phoenix, AZ, 2021.
7. **He Z.**, Tran H., & Pack M., "Entanglement attenuates the entrained air film underneath polymeric droplets", American Physical Society, Division of Fluid Dynamics (DFD), Phoenix, AZ, 2021.
6. **He Z.**, Tran H., & Pack M., "Drop bouncing dynamics on ultra-thin films", American Physical Society, Division of Fluid Dynamics (DFD), Phoenix, AZ, 2021.
5. **He. Z.**, Tran H., & Pack M., "The influence of polymer entanglement on air entrainment dynamics under droplet impacts", Society of Rheology 92nd Annual Meeting, Bangor, ME, 2021.
4. **He Z.**, Tran H., & Pack M., "Effect of polymer concentrations on air entrainment dynamics", American Chemical Society, Colloid & Surface Science Symposium, University Park, PA, 2021.
3. Tran H., **He Z.**, Sakakeeny J., Ling S., & Pack M., "Drop oscillation dynamics on thin immiscible liquid films", American Chemical Society, Colloid & Surface Science Symposium, University Park, PA, 2021.
2. **He Z.**, Tran H., & Pack M., "Drop bouncing dynamics on draining films: the influence of the entrained air layer", American Physical Society, Division of Fluid Dynamics (DFD), Chicago, IL, 2020.
1. **He. Z.**, Tran H., & Pack M., "Drop bouncing dynamics on draining films: the influence of the entrained air layer", American Chemical Society, Colloid & Surface Science Symposium, Houston, TX, 2020.

Poster Presentations

4. **He, Z.**, Upoma, M. A., & Pack, M. Y., "Dual Nature of Volatility in Drop Wetting Dynamics on Lubricated Films", 3M Poster Session at the University of Minnesota, Minneapolis, MN, 2024
3. Suzuki B., Park A., **He Z.**, & Pack M., "Dye, polymer and light interactions using the air entrainment dynamics of droplets", American Physical Society, DFD, Indianapolis, IN, 2022.
2. Park A., **He Z.**, & Pack M., "Dye & light effects on droplet pinch-off dynamics", American Physical Society, DFD, Indianapolis, IN, 2022.
1. **He Z.**, Tran H., & Pack M., "Air entrainment dynamics under shear-thinning droplets", Society of Rheology, Chicago, IL, 2022.

SEMINARS & INVITED TALKS

4. **He, Z.**, Tran, H., & Pack, M. Y. (2023). Capillary wave-assisted Central Collapse of non-Newtonian Droplets. University of Minnesota Twin Cities.
3. **He, Z.**, Tran, H., & Pack, M. (2022). Air entrainment dynamics under shear thinning droplets. Bear Seminar. Baylor University.
2. **He, Z.**, Tran, H., & Pack, M. (2021). Entanglement attenuates the entrained air film underneath polymeric droplets. Bear Seminar. Baylor University.

1. **He, Z.**, Tran, H., & Pack, M. Y. (2021). Drop bouncing dynamics on ultrathin films. Bear Seminar. Baylor University.

HONORS AND AWARDS

- *The Graduate Travel Award*, Department of Mechanical Engineering, Baylor University, Waco, TX, Nov 2019 - Oct 2023
- *APS DFD Travel Grant*, American Physical Society, Phoenix, AZ, Oct 2021
- *Florida Tech Transfer Scholarship*, Department of Mechanical Engineering, Florida Institute of Technology, Melbourne, FL, Aug 2017
- *National Encouragement Scholarship*, Department of Mechanical Engineering, Shijiazhuang TieDao University, Shijiazhuang, Hebei, May 2016
- *Academic Outstanding Student Scholarship*, Department of Mechanical Engineering, Shijiazhuang TieDao University, Shijiazhuang, Hebei, Nov 2015

Mentoring Experience

University of Minnesota

Soyoon Yoon - Undergraduate Research Assistant — Summer 2024
University of Minnesota Twin Cities

Baylor University

5. *Marufa Akter Upoma* - Ph.D. Candidate — Aug 2022 - Dec 2023
   Baylor University
4. *Braven Suzuki* - Mechanical Engineer I — Summer 2022
   Coffman Engineers
3. *Alexandria Park* - Sales Engineer — Summer 2022
   Controlled Fluids Inc.
2. *Olivia Felton* - Graduate Student — Summer 2021
   University of Colorado Boulder
1. *Johann Li* - Master Student — Summer 2021
   The University of North Texas

SKILLS & TECHNIQUES

Software

ImageJ, Labview, MATLAB, Solidworks, ANSYS FLUENT, Origin, JMP, and Microsoft Office.

Equipment

- Nikon A1R Multiphoton Microscope
- Capillary-controlled Microtensiometer
- Photron NOVA S9 High-speed Camera
- Phantom V211 High-speed Camera
- Olympus IX83 Microscope
- Atomic Force Microscope (AFM)
- Scanned Electron Microscope (SEM)
- P-1000 Micropipette Puller
- FLIR Blackfly S USB3 Camera 1.6MP, 226 fps NIKON D2300
- Laurell Spin Coater
- Syringe Pumps (Harvard Apparatus, New Era)
- Anton Paar MCR302e,

- Bohlin Gemini II Rheometer
- OceanOptics spectrometer
- Probe Ultrasonicator
- Corona treator
- Lasers (ThorLabs)
- Kruss K20 tensiometer

Languages
English (Fluent), Mandarin Chinese (Native)

PROFESSIONAL AFFILIATIONS

- American Physical Society (APS)
- American Chemical Society (ACS)
- Society of Rheology (SOR)
- American Society of Mechanical Engineers (ASME)
- Society of Plastic Engineering (SPE)
- Biophysical Society

JOURNAL REFEREES

- Physical Review Journals
- Physics of Fluids
- Journal of Applied Physics
- APL photonics
- Langmuir
- Nanotechnology and Precision Engineering
- Journal of Fluids Engineering