

DI PU

Dept. of Chemical and Petroleum Engineering, University of Calgary, Calgary, AB T2N 1N4

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RESEARCH INTERESTS

- Chemical physics, Soft matter & Interfacial phenomena
- Microfluidics, Biochemical sensing, Drug delivery & controlled release

EDUCATION

University of Calgary <i>Ph.D. in Chemical Engineering</i>	2019 – 2025 Calgary, Canada
University of Regina <i>M.A.Sc. in Petroleum Systems Engineering</i>	2015 – 2019 Regina, Canada
Southwest Petroleum University <i>B.Eng. in Petroleum Engineering</i>	2010 – 2014 Chengdu, China

RESEARCH EXPERIENCE

Graduate Student Researcher Sep. 2019 – Feb. 2025

MicroTransport Lab & Complex Fluids Laboratory, University of Calgary

- Developed a thermofluidic platform with femto-Newton sensitivity for probing chemical interactions at the nano- and microscales.
- Realistic modeling of multiscale interactions at solid-liquid interfaces to understand the origins of temperature and size dependencies of the transport behavior of nano- and micron-sized colloids in electrolyte solutions.
- Mechanistic study of colloid thermophoresis in surfactant solutions, with a focus on quantifying the role of surface chemistry in modulating electrostatic and hydration interactions at silica-water interfaces, using capillary electrophoresis-thermophoresis (CET).
- Microfluidic studies on the thermocapillary migration of surfactant-laden droplets, focusing on microscopic mechanisms underlying interfacial tension-driven flows relevant to liquid-liquid phase separations.
- Led and facilitated training programs for lab staff, focusing on experimental techniques, image analysis, and laboratory safety protocols.

Graduate Student Researcher Sep. 2015 – Apr. 2019

Faculty of Engineering & Applied Science, University of Regina

- Developed a chip-scale platform for *in situ* physicochemical characterization of gas-in-oil dispersions under high-pressure conditions.
- Mechanistic study of nonequilibrium phase behavior in CH₄/CO₂/heavy oil systems & its relevance to bubble nucleation, growth and coalescence.
- Collaborated with international industrial and academic partners on reservoir fluid sampling and post-analysis to support projects with Shaanxi Yanchang Petroleum Group and Southwest Petroleum University.
- Supported EVRAZ Wasco Pipe Protection Corporation in the physicochemical characterization of pipeline coating fluids for industrial applications.

Undergraduate Student Researcher Sep. 2010 – Jul. 2014

School of Oil & Nature Gas Engineering, Southwest Petroleum University

- Application of the Langmuir adsorption model for shale gas reserve estimation.

PUBLICATIONS

6. John, J., Panahi, A., **Pu, D.** and Natale, G., 2024. *Progress in Rheology of Active Colloidal Systems. Current Opinion in Colloid & Interface Science*, 75, p.101886.
5. **Pu, D.**, Panahi, A., Natale, G. and Benneker, A.M., 2024. *Colloid Thermophoresis in Surfactant Solutions: Probing Colloid-Solvent Interactions Through Microscale Experiments. J. Chem. Phys.*, 161 (10), p.104701.
4. Panahi, A., **Pu, D.**, Natale, G. and Benneker, A.M., 2024. *Polymer Concentration Regimes from Fractional Microrheology. Journal of Rheology*, 68 (6), pp.849-862.
3. **Pu, D.**, Panahi, A., Natale, G. and Benneker, A.M., 2024. *A Mode-Coupling Model of Colloid Thermophoresis in Aqueous Systems: Temperature and Size Dependencies of the Soret Coefficient. Nano Letters*, 24 (9), pp.2798-2804.
2. **Pu, D.**, Panahi, A., Natale, G. and Benneker, A.M., 2023. *Colloid Thermophoresis in the Dilute Electrolyte Concentration Regime: From Theory to Experiment. Soft Matter*, 19 (19), pp.3464-3474.
1. **Pu, D.**, 2022. *A Real-Time Visualization Window for Dynamic Observation of Foamy Oil Flow. Chinese Patent CN217132972U. Filed December 28, 2021, and issued August 5, 2022.*

TALKS & POSTERS

3. Design and implementation of a novel thermophoretic device for the separation of colloids, 38th Conference of European Colloid & Interface Society, Copenhagen, Denmark, Sep. 2024 (Poster, co-author)
2. A mode-coupling model of colloid thermophoresis in aqueous media: probing the interactions in many body systems, Canadian Chemical Engineering Conference 2023, Calgary, AB, Oct. 2023 (20 min. talk)
1. Theory and experiment on colloid thermophoresis in aqueous media using lab-on-a-chip platforms, Canadian Chemical Engineering Conference 2022, Vancouver, BC, Oct. 2022 (20 min. talk)

PROFESSIONAL DEVELOPMENT

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| Journal Reviewer
<i>Journal of Chemical Engineering Science</i> | Apr. 2024 |
| Stat & QuantPhys Winter School on "Statistical Physics and Quantum Physics"
<i>Analytical Quantum Complexity RIKEN Hakubi Research Team & Hatano Laboratory</i> | Feb. 2024 |
| Certificate Workshop on "Regulators, Valve Selection & Tube Fitting Installation"
<i>Swagelok Central Canada</i> | Jul. 2017 – Nov. 2017 |

TEACHING & VOLUNTEERING EXPERIENCE

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| Volunteering for the Canadian Chemical Engineering Conference
Chemical Institute of Canada | Oct. 2023
Calgary, AB |
| Teaching Assistant of ENCH 403: Heat Transfer (Laboratory Tutoring/Supervising)
University of Calgary | Fall 2021
Calgary, AB |
| Volunteering for the CCUS-EOR Technical Training for SINOPEC
University of Regina | Feb. 2019 – Mar. 2019
Regina, SK |
| Volunteering for the 2008 Sichuan Earthquake
The First People's Hospital of Guangyuan | Jun. 2008
Guangyuan, China |

AWARDS, GRANTS & HONOURS

Canada First Research Excellence Fund (CFREF) Program	Sep. 2019 – Jan. 2025
The Graduate Excellence Award	Winter 2024
The Graduate Excellence Award	Fall 2020
Line Faculty Scholarship Fund Award	Fall 2017
Faculty of Graduate Studies and Research Graduate Scholarship	Fall 2017

SKILLS

CAD and fabrication: AutoCAD, Soft lithography & Surface modification

Microfluidics: Microfluidic droplet generation system, Microfluidic flow & temperature control

Physicochemical characterization: Bright-field microscopy, Fluorescence intensity & fluorescence lifetime imaging, Dynamic light scattering, Scanning electron microscopy, FTIR, Capillary electrophoresis, Microscale thermophoresis, Pendant drop tensiometry, Benchtop density meter & Capillary/rotational viscometer

Computing software: Python, MATLAB, COMSOL Multiphysics & Fiji Image J

Theoretical skills: Nonequilibrium statistical physics, Low-Reynolds number hydrodynamics & Surface thermodynamics

REFERENCES

Dr. Anne M. Benneker

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Dr. Giovanniantonio Natale

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Prof. Ayodeji Jeje

Professor, Dept. of Chemical and Petroleum Engineering
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Prof. Amr Henni

Professor, Industrial & Process Systems Engineering
University of Regina
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Curriculum Vitae
Updated February 2025