Changwoo Bae, Ph.D.

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Employment History

2025 (Sep.) – Current — **Postdoctral researcher** at Sciences et Ingénierie de la Matière Molle, ESPCI-PSL University, France.

2025 — **Postdoctral researcher** at Institut Lumière Matière, Université de Lyon, France.

2021 — **Research fellow** in Mechanical Engineering, Inha University, South Korea.

2020 — **Research fellow** in Mechanical Engineering, Kyung Hee University, South Korea.

Education

2021 – 2024 — **Ph.D., Physics** in Institut Lumière Matière, Université de Lyon.
Thesis: *'Nanofluidics with Soap Bubbles and Surfactants'*.

2018 – 2020 — **M.E. Mechanical Engineering** in Kyung Hee University.
Thesis title: *'Penetration Dynamics of Water Droplet on Janus Mesh'*.

2010 – 2018 — **B.E. Mechanical Engineering** in Kyung Hee University.
*Military service in the Republic of Korea army (Jan. 2011 - Nov. 2012)

Research Experience

PhD, Nanofluidics in Soap Films 2021 – 2024
(PI: Prof. Anne-Laure Biance)
Agence Nationale de la Recherche (ANR), CNRS, France

- Project aim: Investigate mass, electronic, and ionic transport at liquid/gas interfaces.
- Characterized homemade electronic surfactants using Langmuir-Blodgett and UV-vis.
- Developed techniques for measuring electronic conduction of surfactants.
- Studied bubble translation under electric fields with varying surfactant concentrations.
- Explored soap films as nanochannels for ion/particle depletion effects.
- **Outcome:** 1 first-authored peer-reviewed paper, 1 co-authored peer-reviewed paper, 1 in preparation. 5 international conference papers.

Post-Master Research Fellow, Basic Research Laboratory Program 2021

(PI: Prof. Sunmin Kim)
Ministry of Science, ICT (MSIT), Korea

- Project aim: Studying hypoxia effects on liver and kidney cells in a microfluidic device.
- Developed microchannels for oxygen depletion to near 0%.
- Designed microchannels for concentration and temperature gradients using PEG hydrogel.
- Conducted diffusiophoresis experiments with ionic and non-ionic gradients.
- **Outcome:** 1 domestic conference paper, 1 Korean patent.

Post-Master Research Fellow, National Research Foundation of Korea 2020
(PI: Prof. Choongyeop Lee)
Ministry of Science, ICT and Future Planning (MSIT), Korea

- Project aim: Enhancement of energy conversion through membranes.
- Developed hydrogel and PES membrane-based microchannels for diffusio-phoretic studies.
- Investigated rebound phenomena on LIS with varying viscosity.
- Analyzed penetration and rebound dynamics on LIS meshes.
- **Outcome:** 1 first-authored peer-reviewed paper, 1 co-authored peer-reviewed paper, 1 peer-reviewed conference paper.

Master, National Research Foundation of Korea 2018 – 2020
(PI: Prof. Choongyeop Lee)
Ministry of Science, ICT and Future Planning (MSIT), Korea

- Project aim: Development of nanomaterials for anti-fouling applications.
- Fabricated superhydrophobic and Lubricant-Infused Surfaces (LIS).
- Conducted droplet impact experiments on flexible superhydrophobic mesh.
- Analyzed retraction and contact time on curved surfaces.
- **Outcome:** 1 first-authored peer-reviewed paper, 1 co-authored peer-reviewed paper, 4 conference papers.

Research internship, Basic Research Laboratory Program 2016 – 2018
(PI: Prof. Dukhyun Choi)
Ministry of Science and ICT (MSIT), Korea

- Project aim: Generation of electric energy based on nanostructured surfaces.
- Suggested an idea of an ionic-diode membrane using PDMS and Nafion membrane.
- Developed an experimental setup for energy harvesting in a saline environment.
- Analyzed theoretical redox potential and characterized membrane performance.
- **Outcome:** 1 co-authored peer-reviewed paper.

Research Publications

Journal Articles

1. **C. Bae**, M. Zhao, C. Ybert, and A.-L. Biance, "Reversing the electro-driven bubble transport by tuning surfactant concentration," 2026, In preparation.
2. **C. Bae**, K. Narayanaswamy, H. Idriss, *et al.*, "Electronic interactions of a quatertiophene-based surfactant at the liquid/gas interface," *Soft Matter*, vol. 21, no. 20, pp. 4101–4116, 2025. DOI: 10.1039/D5SM00122F.
3. H. Idriss, S. Albert, **C. Bae**, *et al.*, "Molecular assemblies of amphiphilic oligothiophenes at the air–water interface," *Langmuir*, vol. 41, no. 19, pp. 12 287–12 300, 2025. DOI: 10.1021/acs.langmuir.5c01129.
4. **C. Bae**, Y.-S. Ko, S. Shin, and C. Lee, "A bouncing and rotating drop after oblique impact on lubricant-impregnated surfaces," *Physics of Fluids*, vol. 36, no. 12, 2024. DOI: 10.1063/5.0239361.
5. A. R. Pati, Y.-S. Ko, **C. Bae**, I. Choi, Y. J. Heo, and C. Lee, "Highly porous hydrogels for efficient solar water evaporation," *Soft Matter*, vol. 20, no. 25, pp. 4988–4997, 2024. DOI: 10.1039/D4SM00388H.
6. **C. Bae**, S. Oh, J. Han, Y. Nam, and C. Lee, "Water penetration dynamics through a janus mesh during drop impact," *Soft Matter*, vol. 16, no. 26, pp. 6072–6081, 2020. DOI: 10.1039/D0SM00567C.
7. J. Han, W. Kim, **C. Bae**, *et al.*, "Contact time on curved superhydrophobic surfaces," *Physical Review E*, vol. 101, no. 4, p. 043 108, 2020. DOI: 10.1103/PhysRevE.101.043108.
8. J. Han, **C. Bae**, S. Chae, *et al.*, "High-efficiency power generation in hyper-saline environment using conventional nanoporous membrane," *Electrochimica Acta*, vol. 319, pp. 366–374, 2019. DOI: 10.1016/j.electacta.2019.07.005.

Conference Proceedings

1. **C. Bae**, M. Zhao, C. Ybert, and A.-L. Biance, "Effect of surfactants on the motion of an elongated bubble in an electric field," in *Charged Matter 2025*, Wien, Austria, 2025.
2. **C. Bae**, S. Albert, S. Clément, M. Wang, O. Bonhomme, and A.-L. Biance, "Conductance of an electronic surfactant layer at gas-water interface," in 15^{th} *European Foam Conference (EUFOAM)*, Dresden, Germany, 2024.
3. **C. Bae**, M. Zhao, O. Bonhomme, C. Ybert, C. Cottin-Bizonne, and A.-L. Biance, "Influence of surfactant in the motion of an elongated bubble under electric field," in *American Physical Society (APS) Division of Fluid Dynamics*, Washington DC, USA, 2023.
4. **C. Bae**, M. Zhao, O. Bonhomme, C. Ybert, C. Cottin-Bizonne, and A.-L. Biance, "Influence of surfactants in bubble transport under electric field," in *Journees Plenieres GDR MicroNanoFluidique*, Lyon, France, 2023.
5. **C. Bae**, M. Zhao, O. Bonhomme, C. Ybert, C. Cottin-Bizonne, and A.-L. Biance, "Surfactant driven motion of a bubble under an electric field," in *Congres Français de Mechanique*, Nantes, France, 2022.
6. **C. Bae**, M. Zhao, O. Bonhomme, C. Ybert, C. Cottin-Bizonne, and A.-L. Biance, "Surfactant driven motion of a bubble under an electric field," in *Journées de Physique Statistique*, Paris, France, 2022.
7. **C. Bae**, C. Ha, Y. J. Heo, and C. Lee, "Development of a microfluidic device for applying solute concentration gradient," in *The Korean BioChip Society*, South Korea, 2021.

8. **C. Bae**, Y.-S. Ko, and C. Lee, "Water impact dynamics on oblique lubricant-impregnated surfaces (lis)," in *The* 11^{th} *National Congress of Fluids Engineering*, South Korea, 2020.
9. **C. Bae**, Y.-S. Ko, and C. Lee, "A rebounding and rotating droplet at an inclined surface," in *The Korean Society of Mechanical Engineering Fall Conference*, South Korea, 2019.
10. **C. Bae**, S. Oh, Y. Nam, and C. Lee, "Penetration dynamics of water droplet on janus mesh," in *The Korean Society of Mechanical Engineering Spring Conference*, South Korea, 2019.
11. J. Han, **C. Bae**, D. Lee, *et al.*, "Scaling law for contact time with cylindrical superhydrophobic surfaces during water drop impact," in *The Korean Society of Mechanical Engineering Spring Conference*, South Korea, 2019.
12. **C. Bae**, S. Oh, Y. Nam, and C. Lee, "Penetration dynamics on janus membrane," in *the* 10^{th} *National Congress on Fluids Engineering*, South Korea, 2018.

Thesis

1. **C. Bae**, "Nanofluidics with soap bubbles and surfactants," Ph.D. dissertation, University Lyon 1, 2024. DOI: 10.70675/02660621zf701z424dzbf80z929c123c637f.

Skills

Experimental Techniques

- High-speed imaging and analysis
- Microfluidics and Nanofluidics
- Data analysis and visualization
- Surface characterization (mechanical, electrical, optical, etc.)
- Tensiometry, Zeta potentiometry, Ellipsometry, Electrometry, etc.

Programming & Software

- Python, LaTeX
- Rhinoceros 3D, Adobe Illustrator, Inkscape

Fabrication

- Microfluidic device fabrication (PDMS, NOA, Hydrogel)
- Soft lithography
- Surface functionalization and modification

Honors & Awards

2020 **Excellent Paper Award**, The Korean Society of Mechanical Engineers, South Korea.

2017 **Academic Scholarship**, Kyung Hee University, South Korea.

2009 **Silver Prize** in Korean Physics Olympiad

Teaching & Mentoring

2021-2024
- Mentor for two Master's students on research projects

2019-2020
- Research assistant
- Supervising undergraduate research projects

Professional Activities

Converence Presentations

- Charged Matter 2025, Wien, Austria, 2025
- 15th European Foam Conference (EUFOAM), Dresden, Germany, 2024
- American Physical Society Division of Fluid Dynamics Meeting, Washington DC, 2023
- Journees Plenieres GDR MicroNanoFluidique, Lyon, France, 2023
- Congres Français de Mechanique, Nantes, France, 2022
- Journées de Physique Statistique, Paris, France, 2022
- The Korean BioChip Society, South Korea, 2021
- The 11th National Congress of Fluids Engineering, South Korea, 2020
- The Korean Society of Mechanical Engineering Fall Conference, South Korea, 2019
- The Korean Society of Mechanical Engineering Spring Conference, South Korea, 2019
- The 10th National Congress on Fluids Engineering, South Korea, 2018

Academic Schools

- Complex Motion in Fluids, Homerton College in Cambridge, UK, 2023
- International School of Soft Matter, Cargese, France, 2022

Professional Service

- Reviewer for scientific journals (Physics of Fluids)
- Reviewer for scientific journals (Microfluidics and Nanofluidics)