

Changwoo Bae, Ph.D.

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Employment History

- 2025 – █ **Postdoctoral researcher** in 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 title: *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
(PI: Prof. Anne-Laure Biance)
Agence Nationale de la Recherche (ANR), CNRS, France

2021 – 2024

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

2021

- 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
 (PI: Prof. Choongyeop Lee)
 Ministry of Science, ICT and Future Planning (MSIT), Korea

2020

- 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
 (PI: Prof. Choongyeop Lee)
 Ministry of Science, ICT and Future Planning (MSIT), Korea

2018 – 2020

- 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
 (PI: Prof. Dukhyun Choi)
 Ministry of Science and ICT (MSIT), Korea

2016 – 2018

- 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,” – In preparation.

- 2 C. Bae, K. Narayanaswamy, H. Idriss, *et al.*, "Electronic interactions of a quaterniophene-based surfactant at liquid/gas interface," *Soft Matter*, 2025, – Accepted.
- 3 H. Idriss, S. Albert, C. Bae, *et al.*, "Molecular assemblies of amphiphilic oligothiophenes at the air-water interface," *Langmuir*, 2025, – Accepted.
- 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. 043108, 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, S. Albert, S. Clément, M. Wang, O. Bonhomme, and A.-L. Biance, "Conductance of an electronic surfactant layer at gas-water interface," in *15th European Foam Conference (EUFOAM)*, Dresden, Germany, 2024.
- 2 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.
- 3 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.
- 4 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 Mécanique*, Nantes, France, 2022.
- 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 *Journées de Physique Statistique*, Paris, France, 2022.
- 6 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.
- 7 C. Bae, Y.-S. Ko, and C. Lee, "Water impact dynamics on oblique lubricant-impregnated surfaces (lis)," in *The 11th National Congress of Fluids Engineering*, South Korea, 2020.
- 8 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.
- 9 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.
- 10 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.
- 11 C. Bae, S. Oh, Y. Nam, and C. Lee, "Penetration dynamics on janus membrane," in *the 10th National Congress on Fluids Engineering*, South Korea, 2018.

Skills

Soft skills

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| Languages | English, Korean |
| Coding | Python, L ^A T _E X, HTML |
| Drawing | Inkscape, Rhinoceros 3D, Adobe illustrator |

Research skills

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| Surface Engineering | Photolithography, Surface modification |
| Analysis | Particle image velocimetry (PIV), Particle tracking velocimetry (PTV), Object detection |

Miscellaneous Experience

Awards and Achievements

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| 2020 | Excellent Paper Award, The Korean Society of Mechanical Engineers, South Korea. |
| 2017 | Academic Scholarship, Kyung Hee University, South Korea. |
| 2009 | Silver Prize in Physics, Ulsan Metropolitan Office of Education, South Korea. |

Academic Schools

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