

# Changwoo Bae

Fluid dynamicist & Physicist

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## Education

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- PhD** Institut Lumière Matière, Université de Lyon, PhD in Physics, Material – Lyon, France 2021 – 2024
- Thesis: ‘Nanofluidics with Soap Bubbles and Surfactants’
  - Advisor: Dr. Anne-Laure Bianco
  - Investigated the motion of an air bubble surrounded by ionic surfactants under an electric field.
  - Derived a physical model for the bubble motion.
  - Studied colloid filtration/seiving using bubble-in-capillary configuration.
  - Investigated "electronic" surfactants’ pi-stacking signature at water/air interface using Langmuir Trough and Ellipsometer combined setup.
  - Built a setup to measure conductivity of pi-stacked surfactants and graphene flakes at water/air interface.
- M.E.** KyungHee University, M.E. in Mechanical Engineering – Yongin, South Korea 2018 – 2020
- Thesis: ‘Penetration Dynamics of Water Droplet on Janus Mesh’
  - Advisor: Prof. Choongyeop Lee
  - Investigated on drop impact dynamics on engineered surfaces such as superhydrophobic(SHPo) surfaces, Lubricant-infused surfaces(LIS), Janus membrane, etc.
  - Developed models for penetration dynamics of water droplets on Janus membrane.
  - Studied a contact time reduction on a curved superhydrophobic surface during drop impact.
  - Demonstrated rebound and rotation phenomena on a inclined LIS.
- B.E.** KyungHee University, B.E. in Mechanical Engineering – Yongin, South Korea 2010 – 2018
- Advisor: Prof. Choongyeop Lee
  - Studied free energy harvesting from salt concentration gradient.
  - Demonstrated an ionic diode effect from asymmetric contact areas.

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## Experience

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- SIMM, ESPCI Paris-PSL University**, Postdoctoral Researcher – Paris, France 2025 – present
- Investigating liquid-triboelectrification.
  - Investigating polymer adsorption dynamics.
- Institut Lumière Matière, Université de Lyon**, Postdoctoral Researcher – Lyon, France 2025 – 2025
- Extended Ph.D. research on electro-driven bubble transport with tunable surfactant concentration.
  - Investigated electronic interactions of oligothiophene-based surfactants at liquid/gas interfaces.
  - Mentored a master’s student on experimental techniques and data analysis.
- Inha University**, Research Fellow – Incheon, South Korea 2021 – 2021
- Characterized various properties of hydrogels.
  - Developed novel microfluidic devices for studying diffusioosmosis on superhydrophobic surfaces.
- KyungHee University**, Research Fellow – Yongin, Korea 2020 – 2020
- Studied diffusioosmosis/phoresis on superhydrophobic channel.

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## Publications

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- Reversing the electro-driven bubble transport by tuning surfactant concentration** In preparation  
*Changwoo Bae*, Menghua Zhao, Christophe Ybert, Anne-Laure Bianco
- Electronic interactions of a quaterthiophene-based surfactant at the liquid/gas interface** 2025  
*Changwoo Bae*, Kamatham Narayanaswamy, Hisham Idriss, Ludivine Poyac, Indraneel Sen, Sébastien Richeter, Sébastien Clément, Anne-Laure Bianco, Samuel Albert, Oriane Bonhomme  
10.1039/D5SM00122F (Soft Matter)

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| <b>Molecular Assemblies of Amphiphilic Oligothiophenes at the Air–Water Interface</b>   | 2025 |
| Hisham Idriss, Samuel Albert, <i>Changwoo Bae</i> , Ludivine Poyac, Philippe Gerbier, Oriane Bonhomme, Joséphine Lai-Kee-Him, Aurélie Ancelin, Sébastien Richeter, Indraneel Sen, Karl Leo, Anne-Laure Biance, Sébastien Clément<br>10.1021/acs.langmuir.5c01129 (Langmuir) |      |
| <b>A bouncing and rotating drop after oblique impact on Lubricant-Impregnated surfaces</b>  | 2024 |
| <i>Changwoo Bae</i> , Young-Su Ko, Seungwon Shin, Choongyeop Lee<br>10.1063/5.0239361 (Physics of Fluids)   |      |
| <b>Highly porous hydrogels for efficient solar water evaporation</b>  | 2024 |
| Akash Ranjan Pati, Young-Su Ko, <i>Changwoo Bae</i> , Inhee Choi, Yun Jung Heo, Choongyeop Lee<br>10.1039/D4SM00388H (Soft Matter)  |      |
| <b>Water penetration dynamics through a Janus mesh during drop impact</b>   | 2020 |
| <i>Changwoo Bae</i> , Seungtae Oh, Jeonghoon Han, Youngsuk Nam, Choongyeop Lee<br>10.1039/D0SM00567C (Soft Matter)  |      |
| <b>Contact time on curved superhydrophobic surfaces</b>   | 2020 |
| Jeonghoon Han, Wonjung Kim, <i>Changwoo Bae</i> , Dongwook Lee, Seungwon Shin, Choongyeop Lee, Youngsuk Nam<br>10.1103/PhysRevE.101.043108 (Physical Review E)  |      |
| <b>High-efficiency power generation in hyper-saline environment using conventional nanoporous membrane</b>  | 2019 |
| Jeonghoon Han, <i>Changwoo Bae</i> , Songhwa Chae, Dukhyun Choi, Sangmin Lee, Youngsuk Nam, Choongyeop Lee<br>10.1016/j.electacta.2019.07.005 (Electrochimica Acta)   |      |

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### Conference Talks

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| <b>Charged Matter 2025</b>  | 2025 |
| <b>15th European Foam Conference (EUFOAM)</b>                         | 2024 |
| <b>APS Division of Fluid Dynamics Meeting</b>                         | 2023 |
| <b>Journées Plenières GDR MicroNanoFluidique</b>                      | 2023 |
| <b>Congres Français de Mécanique</b>                                  | 2022 |
| <b>Journées de Physique Statistique</b>                               | 2022 |
| <b>The Korean BioChip Society</b>                                     | 2021 |
| <b>The 11th National Congress of Fluids Engineering</b>               | 2020 |
| <b>The Korean Society of Mechanical Engineering Fall Conference</b>   | 2019 |
| <b>The Korean Society of Mechanical Engineering Spring Conference</b> | 2019 |
| <b>The 10th National Congress on Fluids Engineering</b>               | 2018 |

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### Invited Talks

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| <b>Sciences et Ingénierie de la Matière Molle, ESPCI</b> | 2025 Jul |
| <b>Institut de Physique de Rennes (IPR)</b>              | 2025 Jan |

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### Skills

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**Experimental Techniques:** High-speed imaging, Microfluidics, Surface coating, Tensiometry, Spectroscopy ellipsometry, Atomic Force Microscopy

**Programming & Software:** Python, LaTeX, Rhinoceros 3D, Adobe Illustrator, Inkscape

**Fabrication:** Soft lithography, Surface functionalization

**Expertise:** Hydrodynamics, Thermodynamics, Electrokinetics, Interfacial physics

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## Teaching & Mentoring

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| Mentor for three Master's students | 2021 – 2024 |
| Research assistant                 | 2019 – 2020 |

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## Extracurricular Activities

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

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## Professional Activities

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- Reviewer for Physics of Fluids
- Reviewer for Microfluidics and Nanofluidics

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## Languages

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English, Korean

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## Awards

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| <b>Excellent Paper Award</b><br>The Korean Society of Mechanical Engineers | 2020 |
| <b>Academic Excellence Scholarship</b><br>KyungHee University              | 2017 |
| <b>Silver Prize in Korean Physics Olympiad</b><br>Korea                    | 2009 |