

Yonggyun Bae

Assistant Professor, Ph.D.

Department of Mechanical, Robotics and Energy Engineering, Dongguk University

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Research Interests

- Fundamental 3D numerical simulation
- Multiphysics reacting-flow phenomena (CFD)
- Solid oxide cell (SOFC/SOEC) stack design: bipolar plate, manifold, stacking
- AI-CFD integrated optimization (Bayesian optimization, PINN)
- Catalytic surface reaction kinetics

Education

Yonsei University

Seoul, Korea

Doctor of Philosophy in Mechanical Engineering

February 2021

Thesis: **Development of reliable surface reaction mechanism of low-temperature dry reforming of methane on bi-metallic catalyst**

Thesis advisor: Prof. Jongsup Hong

Korea University

Seoul, Korea

Master of Science in Mechanical Engineering

February 2016

Thesis: **Internal Pressure Fluctuations in Air-conditioner Indoor Unit with Cross-flow Fan**

Thesis advisor: Prof. Young J. Moon

Korea University

Seoul, Korea

Bachelor of Science in Mechanical Engineering

February 2014

Thesis: **Revealing hydrodynamic structures of bathtub vortex**

Thesis advisor: Prof. Young J. Moon

Research Experiences

Department of Mechanical, Robotics and Energy Engineering, Dongguk University

Seoul, Korea

Assistant Professor

September 2026 - present

Department of Zero-carbon Fuel and Power Generation, KIMM

Daejeon, Korea

Senior Researcher

February 2022 - August 2026

- Development of bipolar plate and stack design of solid oxide fuel cell
- Optimal design of electrochemical reacting/heat and mass transfer

Department of Mechanical Engineering, Yonsei University

Seoul, Korea

Post-doctoral Researcher

March 2021 - February 2022

- Elucidating catalytic surface reaction mechanism
- Reactor optimization with integrated reacting-flow phenomena

Research Assistant

March 2017 - February 2021

- Analyzing catalytic surface reaction kinetics
- Elucidating reacting transport coupling phenomena of CO₂ reforming
- Developing newly designed separator and manifold of solid oxide fuel cell stacks

Teaching Assistant	September-December, 2018
- Applied Thermodynamics (MEU3610-03)	
Teaching Assistant	March-June, 2018
- Air Conditioning and Environmental Engineering (MEU4610-01)	
Teaching Assistant	September-December, 2017
- Creative Mechanical Engineering Design II (MEU3300-04)	
Teaching Assistant	March-June, 2017
- Air Conditioning and Environmental Engineering (MEU4610-01)	
High-Temperature Energy Materials Research Center, KIST	Seoul, Korea
Research Assistant	December 2016 - May 2018
- Analyzed potentio-dynamic response of solid oxide fuel cells under electrical load change	
- Elucidated the heat and mass transport taking place in the fuel electrode of high-temperature solid oxide fuel cells	
- Developed newly designed separator and manifold of solid oxide fuel cell stacks	
Department of Mechanical Engineering, Korea University	Seoul, Korea
Teaching Assistant	March-June, 2015
- Basic Concepts of Heat Transfer (MECH311-02)	

Honors and Awards

- Best Paper Award, The Korean Ceramic Society (2025)
- Best Paper Award, The Korean Hydrogen & New Energy Society (2025)
- Best Paper Award, The Korean Hydrogen & New Energy Society (2023)
- OnDream Future Technology Scholarship, Hyundai Motor Chung Mong-Koo Foundation (2019)
- Best Poster Award, IPHE and The Korean Hydrogen & New Energy Society (2019)
- Certificate of Distinction, Best Doctoral Paper, Graduate School of Yonsei University (2018)
- Best Paper Award, School of Mechanical Engineering, Yonsei University (2018)
- Best Poster Award, The Korean Hydrogen & New Energy Society (2018)
- Best Poster Award, The Korean Electrochemical Society (2017)
- Scholarship, Graduate School Student Association, Yonsei University (2017)
- 11th Jojeonghun Academy Award, KAIST (2015)
- Korea Techno Complex Scholarship (2014)
- Alumni Scholarship, Mechanical Engineering, Korea University (2013)
- Honors Student, Mechanical Engineering, Korea University (2013)
- Nogeon Scholarship (2012)
- Best Honors Student, Mechanical Engineering, Korea University (2012)
- Best Honors Student, Mechanical Engineering, Korea University (2011)
- Creative Challenger Scholarship (2011)
- Alumni Scholarship, Mechanical Engineering, Korea University (2010)
- Hongsan Scholarship (2010)

Publications

* Corresponding author

International Journals (29)

1. A.D. Nguyen, J.Y. Park, **Y.G. Bae**, D.K. Lee, Y.S. Kim. "A 20 kW solid oxide electrolysis cell system with hydrogen recirculation: operational performance and thermodynamic evaluation". *Energy Conversion and Management*, 368, 122007 (2026). doi:10.1016/j.enconman.2026.122007

2. S.Y. Kim, B.H. Kang, Y.S. Kim, D.K. Lee, **Y.G. Bae**, J.Y. Park. “Greenhouse cooling demonstration with renewable energy-based tri-generation system”. *Case Studies in Thermal Engineering*, 87, 108566 (2026). doi:10.1016/j.csite.2026.108566
3. B.H. Kang, J.S. Kim, D.K. Lee, **Y.G. Bae**, Y.S. Kim, J.Y. Park. “Ammonia-reformate-fueled PEMFC anode recirculation using cathode-degraded PEMFCs as electrochemical hydrogen pumps”. *Renewable Energy*, 276, 126360 (2026). doi:10.1016/j.renene.2026.126360
4. D.K. Lee, **Y.G. Bae**, J.Y. Park, S.H. Lee, S.Y. Lee, T. Morosuk, Y.S. Kim. “Experimental study and thermodynamic assessment of a bypass-enabled ammonia-fueled SOFC system”. *Case Studies in Thermal Engineering*, 85, 108388 (2026). doi:10.1016/j.csite.2026.108388
5. H.S. Lee, J.W. Baek, **Y.G. Bae***, M.G. Choi*. “Multi-Objective Optimization of Solid Oxide Electrolysis Cell Efficiency and Thermal Gradient using an Active-Learning-CFD Hybrid Framework”. *Applied Thermal Engineering*, 303, 132115 (2026). doi:10.1016/j.applthermaleng.2026.132115
6. W.C. Shin, T.Q. Quach, A.D. Nguyen, D.K. Lee, J.Y. Park, Y.S. Kim, S.Y. Lee, **Y.G. Bae***. “Techno-thermodynamic Investigation of Pressurized Ammonia-fueled SOFC Systems for Co-production of Electricity and Hydrogen”. *Applied Energy*, 417, 128040 (2026). doi:10.1016/j.apenergy.2026.128040
7. B.H. Kang, Y.S. Kim, **Y.G. Bae**, D.K. Lee, J.Y. Park*. “Experimental validation of a fuel cell-based tri-generation system with active heat recovery for greenhouse: Heating”. *Case Studies in Thermal Engineering*, 82, 108119 (2026). doi:10.1016/j.csite.2026.108119
8. A.D. Nguyen, T.Q. Quach, W.C. Shin, D.K. Lee, J.Y. Park, Y.S. Kim, S.Y. Lee, **Y.G. Bae***. “Design and optimization of pressurized ammonia solid oxide fuel cell systems with anode recirculation for co-production of hydrogen and electricity”. *Energy Conversion and Management: X*, 30, 101873 (2026). doi:10.1016/j.ecmx.2026.101873
9. T.Q. Quach, D.K. Lee, Y.S. Kim, **Y.G. Bae**, S.Y. Lee, Y. Kim, J.Y. Park*. “Degradation-considered techno-economic analysis of ammonia solid oxide fuel cell recirculation system using electrochemical hydrogen compressor”. *Journal of Power Sources*, 664, 238919 (2026). doi:10.1016/j.jpowsour.2025.238919
10. T.Q. Quach, D.K. Lee, J.Y. Park, Y.S. Kim, S.H. Lee, H.J. Jang, S.Y. Lee, **Y.G. Bae***. “Comprehensive analysis of a full-scale solid oxide fuel cell stack fueled by ammonia”. *Energy Conversion and Management*, 348, 120618 (2026). doi:10.1016/j.enconman.2025.120618
11. Y.J. Yoon, Y.S. Choi, **Y.G. Bae**, J. Hong*, K.H. Kim*. “Ni-based alloy catalysts for cost-effective hydrogen production from ammonia decomposition”. *Applied Surface Science Advances*, 27, 100759 (2025). doi:10.1016/j.apsadv.2025.100759
12. T. Bui, B.H. Kang, Y.S. Kim, **Y.G. Bae**, D.K. Lee, S.M. Lee, J.Y. Park*. “Fuel cell based tri-generation system for horticulture - part 1. Heating”. *Energy*, 332, 137186 (2025). doi:10.1016/j.energy.2025.137186
13. W. Lee, **Y.G. Bae**, S. Lee, J. Hong*. “Elucidating the dynamic transport phenomena of solid oxide fuel cells according to rapid electrical load change operation”. *Applied Energy*, 359, 122678 (2024). doi:10.1016/j.apenergy.2024.122678
14. D.K. Lee, Y.S. Kim*, **Y.G. Bae**, J.Y. Park, K.Y. Ahn. “Dynamic behavior of an SOEC system with a schedule-based start-up and operating process”. *Journal of Energy Resources Technology*, 146(7), 072102 (2024). doi:10.1115/1.4065210
15. K.P. Hong, M.G. Choi, **Y.G. Bae**, J.H. Min, J.Y. Lee, D.W. Kim, S.H. Bang, H.K. Lee, W.Y. Lee*, J. Hong*. “Direct methane protonic ceramic fuel cells with self-assembled Ni-Rh bimetallic catalyst”. *Nature Communications*, 14, 7485 (2023). doi:10.1038/s41467-023-43388-8
16. T.Q. Quach, Y.S. Kim, D.K. Lee, K.Y. Ahn, S.Y. Lee, **Y.G. Bae***. “Thermal management of Ammonia-fed Solid oxide fuel cells using a novel alternate flow interconnector”. *Energy Conversion and Management*, 291, 117248 (2023). doi:10.1016/j.enconman.2023.117248
17. K. Hong, J. Min, G. Min, **Y.G. Bae**, J. Hong*. “Carbon-neutral conversion of methane supported by Ni-(Rh, Co) bimetallic catalysts for low-temperature proton-conducting ceramic fuel cells”. *Chemical Engineering Journal*, 462, 142334 (2023). doi:10.1016/j.cej.2023.142334
18. D.K. Lee, T.Q. Quach, T.P. Israel, K.Y. Ahn, **Y.G. Bae**, Y.S. Kim*. “Analysis of start-up behavior based on the dynamic simulation of an SOFC-engine hybrid system”. *Energy Conversion and Management*, 272, 116384 (2022). doi:10.1016/j.enconman.2022.116384

19. **Y.G. Bae**, J. Hong*. “Enhancement of surface morphology and catalytic kinetics of NiAl₂O₄ spinel-derived Ni catalyst to promote dry reforming of methane at low temperature for the direct application to a solid oxide fuel cell”. *Chemical Engineering Journal*, 446, 136978 (2022). doi:10.1016/j.cej.2022.136978
20. J. Lee, **Y.G. Bae**, K. Hong, J. Hong*. “Comparative evaluation of Ni-based bimetallic catalysts for dry reforming of methane at low temperature: the effect of alloy itself on performance”. *International Journal of Energy Research*, 46(8), 11228-11249 (2022). doi:10.1002/er.7923
21. D.H. Kim, **Y.G. Bae**, S.H. Lee, J.W. Son, J.H. Shim, J. Hong*. “Thermal analysis of a 1-kW hydrogen-fueled solid oxide fuel cell stack by three-dimensional numerical simulation”. *Energy Conversion and Management*, 222, 113213 (2020). doi:10.1016/j.enconman.2020.113213
22. **Y.G. Bae**, S.H. Lee, J. Hong*. “The effect of anode microstructure and fuel utilization on current relaxation and concentration polarization of solid oxide fuel cell under electrical load change”. *Energy Conversion and Management*, 201, 112152 (2019). doi:10.1016/j.enconman.2019.112152
23. J.Y. Kim, D.H. Kim, W.S. Lee, S.H. Lee, **Y.G. Bae**, J. Hong*. “Thermo-fluid analysis of a planar solid oxide fuel cell with an improved flow field by manifold and flow channel design”. *ECS Transactions*, 91(1), 255-262 (2019). doi:10.1149/09101.0255ecst
24. H.Y. Jeong, S.W. Kim, **Y.G. Bae**, K.J. Yoon, J.H. Lee, J. Hong*. “Effect of Fe infiltration to Ni/YSZ solid-oxide-cell fuel-electrode on steam/CO₂ co-electrolysis”. *International Journal of Energy Research*, 43, 4949-4958 (2019). doi:10.1002/er.4577
25. H. Han, **Y.G. Bae**, S.T. Hwang, H.Y. Kim, I. Park, S.M. Kim, Y.H. Choe, Y.J. Moon*, J.H. Choi*. “Computationally simulated fractional flow reserve from coronary computed tomography angiography based on fractional myocardial mass”. *International Journal of Cardiovascular Imaging*, 35, 185-193 (2019). doi:10.1007/s10554-018-1432-z
26. S.H. Lee, **Y.G. Bae**, K.J. Yoon, J.H. Lee, W.J. Choi, J. Hong*. “Key characteristics of a hydrocarbon-fueled solid oxide fuel cell examined by local thermodynamic states”. *Energy Conversion and Management*, 174, 565-578 (2018). doi:10.1016/j.enconman.2018.08.064
27. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.H. Lee, J. Hong*. “Three-dimensional dynamic modeling and transport analysis of solid oxide fuel cells under electrical load change”. *Energy Conversion and Management*, 165, 405-418 (2018). doi:10.1016/j.enconman.2018.03.064
28. S.W. Kim, **Y.G. Bae**, K.J. Yoon, J.H. Lee, J. Hong*. “High-temperature electrolysis of CO₂-enriched mixtures by using fuel-electrode supported La_{0.6}Sr_{0.4}CoO₃/YSZ/Ni-YSZ solid oxide cells”. *Journal of Power Sources*, 378, 369-374 (2018). doi:10.1016/j.jpowsour.2017.12.060
29. **Y.G. Bae**, S.T. Hwang, H. Han, S.M. Kim, H.Y. Kim, I. Park, J.M. Lee, J.H. Choi, Y.J. Moon*. “Non-invasive coronary physiology based on computational analysis of intracoronary transluminal attenuation gradient”. *Scientific Reports*, 8(1), 4692 (2018). doi:10.1038/s41598-018-23134-7

Domestic Journals (15)

1. D.K. Lee, T.Q. Quach, A.D. Nguyen, J.Y. Park, **Y.G. Bae**, Y.S. Kim*. “Integrating LLM and Multioutput Logistic Regression for HAZOP Prediction”. *Trans. of the Korean Hydrogen and New Energy Society*, 36(6), 714-723 (2025). doi:10.7316/jhne.2025.36.6.714
2. W.C. Shin, D.K. Lee, J.Y. Park, Y.S. Kim, S.Y. Lee, **Y.G. Bae***. “Operation Strategy of Pressurized Solid Oxide Fuel Cell System Fueled by Ammonia”. *Trans. of the Korean Hydrogen and New Energy Society*, 36(5), 535-541 (2025). doi:10.7316/jhne.2025.36.5.535
3. T. Bui, J.Y. Park*, D.K. Lee, **Y.G. Bae**, Y.S. Kim, S.M. Lee. “Fuel Cell-based Tri-generation System Operating Strategy for Horticulture”. *Trans. of the Korean Hydrogen and New Energy Society*, 35(6) (2024). doi:10.7316/jhne.2024.35.6.690
4. K.Y. Lee, D.H. Chung, **Y.G. Bae**, J.M. Bae*. “Catalyst Infiltration on Anode of SOFC for Direct Utilization of Ammonia”. *Trans. of the Korean Hydrogen and New Energy Society*, 35(6), 667-672 (2024). doi:10.7316/jhne.2024.35.6.667
5. **Y.G. Bae***, T.Q. Quach, D.K. Lee, J.Y. Park, Y.S. Kim, S.Y. Lee. “Development of NH₃-Fed Solid Oxide Fuel Cell Stack by KIMM”. *Trans. of the Korean Society of Mechanical Engineers B*, 48(12) (2024). doi:10.3795/ksme-b.2024.48.12.817

6. J.Y. Park*, T.Q. Quach, J.S. Kim, **Y.G. Bae**, D.K. Lee, Y.S. Kim, S.Y. Lee, Y. Kim. "Ammonia-fueled Solid Oxide Fuel Cell Recirculation Systems for Power Generation". *Trans. of the Korean Hydrogen and New Energy Society*, 35(1), 40-47 (2024). doi:10.7316/jhne.2024.35.1.40
7. J.Y. Park*, T. Bui, S.Y. Park, D.K. Lee, **Y.G. Bae**, Y.S. Kim, S.M. Lee. "Fuel Cell-based Cogeneration System for Greenhouse Cooling and Heating". *Trans. of the Korean Hydrogen and New Energy Society*, 34(6), 667-672 (2023). doi:10.7316/jhne.2023.34.6.667
8. T.Q. Quach, **Y.G. Bae**, K.Y. Ahn, S.Y. Lee, Y.S. Kim*. "Exergetic Analysis of Ammonia-fueled Solid Oxide Fuel Cell Systems for Power Generation". *Journal of the Korean Institute of Gas*, 27(3), 27 (2023).
9. T.H. Kim, D.Y. Kim, D.K. Lee, Y.S. Kim, K.Y. Ahn, **Y.G. Bae**, J.Y. Park, Y. Kim. "Study on thermodynamic performance of electrochemical hydrogen compressor". *Trans. of the Korean Hydrogen and New Energy Society*, 34(2), 141-148 (2023). doi:10.7316/jhne.2023.34.2.141
10. D.Y. Kim, T.H. Kim, D.K. Lee, Y.S. Kim, K.Y. Ahn, **Y.G. Bae**, J.Y. Park, Y. Kim. "Study on Electrochemical Hydrogen Separation of Hydrogen and Nitrogen Mixture Gas". *Trans. of the Korean Hydrogen and New Energy Society*, 34(2), 149-154 (2023). doi:10.7316/jhne.2023.34.2.149
11. D.K. Lee, T.P. Israel, **Y.G. Bae**, Y.S. Kim*, K.Y. Ahn, S.Y. Lee. "Analysis of levelized cost of electricity for type of stationary fuel cells". *Trans. of the Korean Hydrogen and New Energy Society*, 33(6), 643-659 (2022). doi:10.7316/khnes.2022.33.6.643
12. V.T. Giap, T.Q. Quach, K.Y. Ahn, **Y.G. Bae**, S.Y. Lee, Y.S. Kim*. "1D kinetics model of NH₃-fed solid oxide fuel cell". *Trans. of the Korean Hydrogen and New Energy Society*, 33(6), 723-732 (2022). doi:10.7316/khnes.2022.33.6.723
13. T.Q. Quach, V.T. Giap, D.K. Lee, S.Y. Lee, **Y.G. Bae**, K.Y. Ahn, Y.S. Kim*. "Performance analysis of ammonia-fed solid oxide fuel cell using alternating flow". *Trans. of the Korean Hydrogen and New Energy Society*, 33(5), 557-565 (2022). doi:10.7316/khnes.2022.33.5.557
14. T. Bui, Y.S. Kim*, D.K. Lee, K.Y. Ahn, **Y.G. Bae**, S.M. Lee. "Economic Analysis and Comparison between Low-Power and High-Power SOEC Systems". *Trans. of the Korean Hydrogen and New Energy Society*, 33(6), 707-714 (2022). doi:10.7316/khnes.2022.33.6.707
15. **Y.G. Bae**, D.H. Kim, S.T. Hwang, Y.J. Moon*. "Three-dimensional flow computation and performance characteristics analysis of propellers for water treatment mixer". *Journal of Computational Fluids Engineering*, 20(1), 10-15 (2015). doi:10.6112/kscfe.2015.20.1.010

Conferences

International Conferences (9)

1. **Y.G. Bae***, K.Y. Ahn, Y.S. Kim, J.Y. Park, D.K. Lee. "Thermochemical Variable Analysis of Solid Oxide Fuel Cell with 3D Multi-physical Simulation". *ECOS 2023*, Las Palmas de Gran Canaria, Spain (2023). (oral)
2. T.Q. Quach, D.K. Lee, T. Bui, Y.S. Kim, **Y.G. Bae***, K.Y. Ahn. "Nitrogen/Hydrogen as thermochemical energy storage material in NH₃ fed reversible solid oxide fuel cell system for electrical energy storage". *ECOS 2022*, Copenhagen, Denmark (2022). (oral)
3. **Y.G. Bae**, J. Hong*. "Reaction kinetics of catalytic dry reforming of methane on spinel-derived nickel catalyst at low-temperature using an in-situ stagnation-flow reactor". *PRiME 2020*, Online (2020). (poster)
4. **Y.G. Bae**, J. Hong*. "Surface reaction kinetics of dry reforming of methane on Ni/Al₂O₃ catalyst at low-temperature using an in-situ stagnation-flow reactor". *PACRIM13*, Okinawa, Japan (2019). (poster)
5. **Y.G. Bae**, J. Hong*. "Investigation of surface reaction kinetics of dry reforming of methane on Ni/Al₂O₃ catalyst at low temperature using an in-situ stagnation flow reactor". *32nd IPHE Outreach Event*, Seoul, Korea (2019). (poster)
6. **Y.G. Bae**, J. Hong*. "Characteristics of surface reaction kinetics of methane assisted by CO₂ on Ni/Al₂O₃ catalyst at low temperature using an in-situ stagnation flow reactor". *MODEGAT VI*, Bad Herrenalb, Germany (2019). (poster)
7. **Y.G. Bae**, J. Hong*. "Reaction mechanism analysis of dry reforming of methane on Ni/Al₂O₃ catalyst at low temperature using an in-situ stagnation flow reactor". *ICOSCAR6*, Bad Herrenalb, Germany (2019). (poster)

8. **Y.G. Bae**, J. Hong*. “Reaction kinetics of catalytic dry reforming of methane on Ni/Al₂O₃ at low-temperature using a stagnation-flow reactor”. **SSI-22 (2019)**, Pyeongchang, Korea (2019). (poster)
9. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.H. Lee, J. Hong*. “Dynamic response of solid oxide fuel cell: The effect of anode microstructure on transport phenomena under electrical load change”. **MCARE 2018**, Vancouver, British Columbia, Canada (2018). (invited oral)

Domestic Conferences (14)

1. **Y.G. Bae***, Y.S. Kim, J.Y. Park, D.K. Lee, S.Y. Lee. “Development of NH₃-fed solid oxide fuel cell stack by KIMM”. **2024 KSME Fall Meeting**, Jeju, Korea (2024). (oral)
2. **Y.G. Bae***, T.Q. Quach, D.K. Lee, J.Y. Park, Y.S. Kim, S.Y. Lee. “Thermal management of NH₃-fed SOFC using a novel alternative flow interconnector”. **2024 KECS Spring Meeting**, Busan, Korea (2024). (invited talk)
3. **Y.G. Bae***, K.Y. Ahn, Y.S. Kim, J.Y. Park, D.K. Lee. “Development of NH₃-fed solid oxide fuel cell stack by KIMM”. **2023 KHNES Fall Meeting**, Jeju, Korea (2023). (oral)
4. T.Q. Quach, Y.S. Kim, D.K. Lee, K.Y. Ahn, S.Y. Lee, **Y.G. Bae***. “Thermal management of NH₃-fed solid oxide fuel cell by using a novel alternate flow interconnector”. **2023 KSME Spring Meeting**, Busan, Korea (2023). (oral)
5. **Y.G. Bae***, K.Y. Ahn, Y.S. Kim, J.Y. Park, D.K. Lee. “Thermochemical variable analysis of solid oxide fuel cell with 3D multi-physical simulation”. **2022 KHNES Fall Meeting**, Jeju, Korea (2022). (oral)
6. **Y.G. Bae**, J. Hong*. “Development of reaction kinetics for catalytic dry reforming of methane on Ni/Al₂O₃ at low-temperature using an in-situ stagnation-flow reactor”. **2019 KSME Spring Meeting**, Busan, Korea (2019). (oral)
7. **Y.G. Bae**, J. Hong*. “Dynamic response of solid oxide fuel cell: The effect of transport phenomena on polarization losses under electrical load change”. **2019 KSS Symposium**, Busan, Korea (2019). (young scientist session, oral)
8. **Y.G. Bae**, J. Hong*. “Reaction mechanism study of low temperature catalytic dry reforming of methane on Rh/Al₂O₃ catalysts using a stagnation-flow reactor”. **2018 KSME Fall Meeting**, Jeongseon, Korea (2018). (oral)
9. **Y.G. Bae**, J. Hong*. “Reaction kinetics of low temperature catalytic dry reforming of methane on Rh/Al₂O₃ catalysts using stagnation-flow reactor”. **2018 KCers Fall Meeting**, Seoul, Korea (2018). (poster)
10. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.H. Lee, J. Hong*. “Dynamic response of solid oxide fuel cell: The effect of anode microstructure and operating conditions on transport phenomena under electrical load change”. **2018 KHNES Fall Meeting**, Changwon, Korea (2018). (poster)
11. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.H. Lee, J. Hong*. “Dynamic response of solid oxide fuel cell: The effect of anode microstructure on transport phenomena under electrical load change”. **2018 KSME Spring Meeting**, Jeju, Korea (2018). (oral)
12. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.W. Son, J.H. Lee, B.K. Kim, J. Hong*. “3D dynamic modeling and thermomechanical analysis of solid oxide fuel cells under load change”. **2017 KSME Spring Meeting**, Busan, Korea (2017). (oral)
13. **Y.G. Bae**, S.H. Lee, K.J. Yoon, J.W. Son, J.H. Lee, B.K. Kim, H.W. Lee, J. Hong*. “3D dynamic modeling and thermomechanical analysis of solid oxide fuel cells under load change”. **2017 KECS Spring Meeting**, Jeju, Korea (2017). (poster)
14. **Y.G. Bae**, J.T. Park, Y.J. Moon*. “Internal pressure fluctuations in air-conditioner indoor unit with cross-flow fan”. **2015 KSCFE Fall Meeting**, Ansan, Korea (2015). (oral)

Patents

Registered (12)

1. K.Y. Ahn, Y.S. Kim, D.K. Lee, **Y.G. Bae**, J.Y. Park, T.Q. Quach. “Multi-stage recirculation fuel cell system and multi-stage recirculation fuel cell power generation method using the same”. **KR 10-2924411** (2026)
2. K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, D.K. Lee, T.P. Israel. “Pipe type manifold for fuel cell and fuel cell system including the same”. **KR 10-2872695** (2025)

3. K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, D.K. Lee. "Hydrogen production and compression apparatus, and hydrogen production and compression method using the same". **KR 10-2810525** (2025)
4. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "Fuel cell with improved thermal distribution in stack". **US 11050066** (2021)
5. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "Separator for fuel cell including guide pattern and fuel cell stack including the same". **US 11050065** (2021)
6. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "Fuel cell with improved thermal distribution in stack". **JP 6892654** (2021)
7. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "Separator for fuel cell including guide pattern and fuel cell stack including the same". **JP 6804068** (2020)
8. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "A separator for a fuel cell and a fuel cell stack comprising the same". **US 10840533** (2020)
9. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "A fuel cell with improving thermal distribution inside stack". **KR 10-2140468** (2020)
10. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "A separator for a fuel cell and a fuel cell stack comprising the same". **KR 10-2027764** (2019)
11. J.S. Hong, **Y.G. Bae**, S.H. Lee, D.H. Kim, K.J. Yoon, J.H. Lee. "A separator for a fuel cell comprising a guide pattern and a fuel cell stack comprising the same". **KR 10-2017486** (2019)
12. Y.J. Moon, D.H. Kim, **Y.G. Bae**, S.T. Hwang. "Contra rotating propeller unit for mixing fluids". **KR 10-1645982** (2016)

Applied for (Korea) (15)

1. J.Y. Park, S.Y. Kim, D.K. Lee, **Y.G. Bae**, Y.S. Kim, J.E. Chae, J.S. Choi, S.Y. Lee, J. Young, Y. Kim. "Fuel cell system utilizing fuel cells". **KR 10-2025-0181927** (2025)
2. J.Y. Park, Y.S. Kim, **Y.G. Bae**, D.K. Lee, B.H. Kang, S.Y. Kim, H.R. Park. "Heating and cooling system including heat pump". **KR 10-2025-0176135** (2025)
3. Y.S. Kim, **Y.G. Bae**, J.Y. Park, D.K. Lee, S.Y. Lee. "Fuel cell device with heterogeneous fuel cell stacks connected in series". **KR 10-2025-0162028** (2025)
4. Y.S. Kim, **Y.G. Bae**, J.Y. Park, D.K. Lee, Y.K. Kim. "Methane reforming partial oxidation system for producing syngas using solid oxide cells". **KR 10-2025-0152579** (2025)
5. Y.S. Kim, **Y.G. Bae**, J.Y. Park, D.K. Lee, Y.K. Kim. "Solid oxide cell system". **KR 10-2025-0151776** (2025)
6. D.K. Lee, Y.S. Kim, **Y.G. Bae**, J.Y. Park, Y. Kim, J.C. Kim, J. Young. "Heat pump system using electrochemical cell". **KR 10-2025-0140281** (2025)
7. D.K. Lee, J.Y. Park, Y.S. Kim, **Y.G. Bae**, Y. Kim, J.C. Kim, J. Young, S.Y. Kim, J.E. Chae, J.S. Choi. "Chemical looping compression assembly and heat pump system including the same". **KR 10-2024-0080254** (2024)
8. J. Young, J.C. Kim, Y. Kim, D.K. Lee, J.Y. Park, **Y.G. Bae**, Y.S. Kim, S.Y. Kim, J.E. Chae, J.S. Choi. "Heat pump". **KR 10-2024-0080224** (2024)
9. Y.S. Kim, B.V.T. Ahn, J.Y. Park, D.K. Lee, **Y.G. Bae**, K.Y. Ahn. "Solid oxide electrolysis cell cascade system". **KR 10-2024-0016132** (2024)
10. J.Y. Park, D.K. Lee, **Y.G. Bae**, Y.S. Kim, K.Y. Ahn. "Solid oxide fuel cell recirculation system using an electrochemical hydrogen pump". **KR 10-2023-0171625** (2023)
11. D.K. Lee, K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, J.Y. Park, Y. Kim. "Multi-stage electrochemical hydrogen compressor and control method thereof". **KR 10-2023-0120727** (2023)
12. J.Y. Park, K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, D.K. Lee, S.M. Lee. "Heating and cooling system of greenhouse". **KR 10-2023-0111549** (2023)
13. D.K. Lee, K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, J.Y. Park. "Adsorption heat pump with improved thermal efficiency, and cooling and heating method using the adsorption heat pump". **KR 10-2023-0064635** (2023)

14. D.K. Lee, K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, J.Y. Park. “Hydrogen compressing apparatus having buffer perforated plate”. **KR 10-2023-0063408** (2023)
15. **Y.G. Bae**, K.Y. Ahn, Y.S. Kim, J.Y. Park, D.K. Lee, T.Q. Quach. “Electrolyte supported fuel cell”. **KR 10-2022-0186322** (2022)

International Applications (PCT) (2)

1. J.Y. Park, D.K. Lee, **Y.G. Bae**, Y.S. Kim, K.Y. Ahn. “Solid oxide fuel cell recirculation system”. **PCT/KR2024/017683** (2024)
2. D.K. Lee, K.Y. Ahn, Y.S. Kim, **Y.G. Bae**, J.Y. Park, Y. Kim. “Multi-stage electrochemical hydrogen compressor and control method thereof”. **PCT/KR2024/013797** (2024)

Technology Transfer

1. “Operation technology for renewable energy-based tri-generation system” Transferred to Chungbo Engineering Co., Ltd. **(2025)**. *IP: Patent application KR 10-2025-0176135 (Heating and cooling system including heat pump).*
2. “Software module package for electrochemical energy systems” Transferred to UIT Co., Ltd. **(2024)**. *IP: Membrane humidifier performance calculation program; Pressure swing adsorber performance calculation program; Solid oxide electrolysis stack performance calculation program; Polymer electrolyte membrane electrolysis stack performance calculation program.*
3. “Solid oxide fuel cell performance calculation program” Transferred to UIT Co., Ltd. **(2023)**. *IP: Software registration C-2021-046617 (2021.11.11).*
4. “SOFC separator and stack design with improved thermal distribution” Transferred to PNP EnergyTech **(2019)**. *IP: KR 10-2018-0036939; KR 10-2017486; KR 10-2018-0169046.*

Research Projects

As Principal Investigator

1. **“Development of a high-efficiency SOEC stack with simultaneous steam supply to both electrodes for reducing hydrogen production cost and utilizing high-purity oxygen”**
International Joint R&D Program, Ministry of Trade, Industry and Energy (MOTIE)
Principal Investigator (lead institution: KIMM) | July 2025 - August 2026
2. **“Optimal design of bipolar plate flow channels to suppress steam-electrode degradation in SOEC”**
H2GATHER, National Research Foundation of Korea (NRF): Advancing the Durability of Solid Oxide Electrolysis Cells, A Global Collaborative Research Framework
Principal Investigator of participating institution (KIMM) | April 2025 - August 2026
3. **“Start-up technology and AI-based health management for ammonia fuel conversion of SOFC systems”**
ACE Program, KIMM (industry partner: HnPower Co., Ltd.)
Principal Investigator | January 2026 - August 2026
4. **“Development of a numerical model for water electrolysis for comprehensive analysis of multiphysics phenomena”**
Contract research, POSCO Holdings
Principal Investigator | January 2023 - December 2023

As Participant: National Projects

1. “Development of planar cells, 20kW class stack modules and systems for large-scale, high-efficiency SOEC”, **Funding: Ministry of Trade, Industry and Energy** (2021-2025)
2. “Development of horticultural energy model based on hydrogen fuel cell tri-generation system”, **Funding: Rural Development Administration** (2021-2025)
3. “Development of manufacturing technology for improving high temperature durability and efficiency of metal bipolar for SOFC”, **Funding: Ministry of Trade, Industry and Energy** (2020-2022)

4. “Chemisorption heat pump system using electrochemical compressor”, **Funding: Ministry of Trade, Industry and Energy** (2019-2025)
5. “The development of high-efficiency modular SOFC system with extensible power generation”, **Funding: Korea Evaluation Institute of Industrial Technology** (2019-2022)
6. “Reaction mechanism development of high performance/high selectivity/high durability heterogeneous bi-metallic catalyst for carbon-neutral dry reforming of methane”, **Funding: National Research Foundation of Korea** (2019-2021)
7. “Long-term stable protonic ceramic fuel cells with large-scale nano-multi-layer structures implementing over 1 W/cm² at 300-500 degC”, **Funding: Korea Institute of Energy Technology Evaluation and Planning** (2017-2020)
8. “Development of core-technology for sustainable energy conversion systems facilitating oxy-fuel conversion and CO₂ utilization”, **Funding: National Research Foundation of Korea** (2018-2019)
9. “Smart design of SOFC repeating units for thermal-electrical load following by integrative multiphysics analysis”, **Funding: Ministry of Science, ICT and Future Planning** (2017-2022)

As Participant: Industry Projects

1. “Technology development to reduce fine dust and black carbon emission for ships”, **Funding: Korea Shipbuilding & Offshore Engineering Co., Ltd.** (2020-2021)

Professional Activities

- Expert Advisory Committee Member for Renewable Energy, Seoul Metropolitan Government (May 2025 - May 2027)
- Planning Advisory Committee Member, 2026 New R&D Projects in Hydrogen (Production), KETEP (October 2025)
- Planning Advisory Committee Member, 2025 Energy Technology Development Program, New Projects in Fuel Cells (Ammonia SOFC), KETEP (November 2024)

Teaching Interests

- Introduction to MATLAB and Python for Mechanical Engineers, Thermodynamics, Fluid Dynamics, Heat Transfer, Combustion and Fuel Cell, Energy Conversion Engineering, Renewable Energy