

Benjamin Highsmith Meekins

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Curriculum Vitae

RESEARCH AND WORK EXPERIENCE

University of South Carolina	Columbia, SC	2025-present
Research Associate Professor		
University of South Carolina	Columbia, SC	2019-present
Assistant Director, Hydrogen and Fuel Cell Center		
University of South Carolina	Columbia, SC	2016-present
Research Assistant Professor		
University of Texas – Austin	Austin, TX	2015-2016
Physical Chemistry Lab Coordinator		
University of Texas – Austin	Austin, TX	2014-2016
Researcher under Dr. C. Buddie Mullins		
University of Texas – Austin	Austin, TX	2012-2014
Postdoctoral Researcher under Dr. Allen Bard		
University of Notre Dame	Notre Dame, IN	2007-2012
Graduate Research Assistant under Dr. Prashant Kamat		
University of South Carolina	Columbia, SC	2006-2007
Undergraduate Research Assistant under Dr. J. W. Van Zee		
University of South Carolina School of Medicine	Columbia, SC	2005
Undergraduate Research Assistant under Dr. Marlene Wilson		

EDUCATION

University of Notre Dame	Notre Dame, IN	2007-2012
PhD and M.S., Chemical and Biomolecular Engineering		
Thesis: “Photocatalyst/Co-catalyst Systems and Their Roles in Enhancing Water Oxidation”		
Advisor: Prashant V. Kamat		
University of South Carolina	Columbia, SC	2003-2007
Bachelor of Science in Chemical Engineering, <i>cum laude</i>		
Honors Diploma, Tau Beta Pi member		
Thesis: “Exergy Analysis of a Methyl Tertiary-Butyl Ether Production Plant”		
Advisor: Dr. Thomas Stanford		

PUBLICATIONS (MOST RECENT FIRST; * DENOTES CORRESPONDING)

1. Kris Likit-Anurak, Ishwor Karki, Kanchi Ngamsanroaj, Brian C. Benicewicz, Sirivatch Shimpalee, Benjamin H. Meekins*. *Determination of H₂ Crossover in Polybenzimidazole-Based Membrane Electrode Assemblies*. **J. Electro. Soc.** 2025, 172(11).
2. Olusegun Felix, Kris Likit-anurak, Kanchit Ngamsanroaj, Sirivatch Shimpalee, Benjamin Meekins*. *A comparative techno-economic analysis of aqueous and anhydrous HCl electrolysis processes*. **Int. J. of Hydrogen Energy**. 2025, 143, 15-24.
3. Kris Likit-anurak, Hunter R. Tell, Ishwor Karki, Ben I. Howard, Brian C. Benicewicz, Sirivatch Shimpalee*, Benjamin H. Meekins*. *Development of an Experimentally Validated Computational Fluid Dynamics Model for an Anhydrous HCl Electrolyzer*. **J. Electrochem. Soc.** 2024, 171(5), 054512.
4. Kris Likit-anurak, Ishwor Karki, Ben I Howard, Laura Murdock, Nikolai Mukhin, Jamie Brannon, Aubrey Hepstall, Bridgett Young, Sirivatch Shimpalee, Brian Benicewicz, Benjamin Meekins*. *Polybenzimidazole Membranes as Nafion Replacement in Aqueous HCl Electrolyzers*. **ACS Appl. Ener. Mat.** 2023, 6(10), 5429-5434.
5. Kris Likit-Anurak, Rembert White, Laura Murdock, Brian Benicewicz, Sirivatch Shimpalee, Benjamin Meekins*. *Fully Anhydrous HCl Electrolysis Using Polybenzimidazole Membranes*. **Int. J. of Hydrogen Energy**. 2022, 47(63), 26859-26864.
6. Héctor R. Colón-Mercado, Scott A. Mauger, Maximilian B. Gorenssek, Cy H. Fujimoto, Aaron A. Lando, Prabhu Ganesan, Benjamin H. Meekins, Noah D. Meeks. *Electrode optimization for efficient hydrogen production using an SO₂-depolarized electrolysis cell*. **Int. J. of Hydrogen Energy**. 2022, 47(31), 14180-14185.
7. Héctor R. Colón-Mercado, Maximilian B. Gorenssek, Cy H. Fujimoto, Aaron Lando, and Benjamin H. Meekins. *High-performance SO₂-Depolarized Electrolysis Cell Using Advanced Polymer Electrolyte Membranes*. **Int. J. of Hydrogen Energy**. 2022, 47(1), 57-68. (<https://doi.org/10.1016/j.ijhydene.2021.10.019>)
8. Maximilian B. Gorenssek, Benjamin Meekins*, Hector Colon-Mercado, John Weidner. *Parametric study of operating conditions of an SO₂-depolarized electrolyzer*. **Int. J. of Hydrogen Energy**. 2020, 45(43), 22408-22418.
9. B. H. Meekins, Anthony B. Thompson, Varsha Gopal, Bahareh A Tavakoli Mehrabadi, Mark C Elvington, Prabhu Ganesan, Ty A. Newhouse-Illige, Adam W. Sheperd, Lawrence E. Scipioni, James A. Greer, John C Weiss, John W Weidner, Hector Colon-Mercado. *In-situ and ex-situ comparison of the electrochemical oxidation of SO₂ on carbon supported Pt and Au catalysts*. **Int. J. of Hydrogen Energy**. 2020, 45(3), 1940-1947.
10. Kennedy, A., & Meekins, B.* *Combustion synthesis and photoelectrochemical characterization of gallium zinc oxynitrides*. **J. Mat. Res.** 2018, 33(23), 3971-3978. (DOI: 10.1557/jmr.2018.402)
11. Meekins, B. H.* *Detection of Single Metal Nanoparticle Collision Events in Non-Aqueous Media*. **Phys. Chem. Chem. Phys.** 2017, 19 (26), 17256-17262. (DOI: 10.1039/C7CP03042H)
12. Ki Min Nam, Hyun S. Park, Heung Chan Lee, Benjamin H. Meekins, Kevin C. Leonard, and Allen J. Bard. *Compositional Screening of the Pb-Bi-Mo-O System*. *Spontaneous*

Formation of a Composite of p-PbMoO₄ and n-Bi₂O₃ with Improved Photoelectrochemical Efficiency and Stability, **J. Phys. Chem. Lett.** 2013, 4, pp 2707–2710 (DOI: 10.1021/jz401334k)

13. Meekins, B. H.; Lin, Y.-C.; Manser, J. S.; Manukyan, K.; McGinn, P. J.; Mukasyan, A.; Kamat, P. V. *Photoactive Porous Silicon Nanopowder*, **ACS Appl. Mater. Interfaces**. 2013, 5 (8), 2943-2951. (DOI: 10.1021/am3031745)
14. Meekins, B. H.; Kamat, P. V. *Role of Water Oxidation Catalyst IrO₂ in Shuttling Photogenerated Holes Across TiO₂ Interface*. **J. Phys. Chem. Lett.** 2011, 2, 2304-2310. (<http://dx.doi.org/10.1021/jz200852m>)
15. Meekins, B. H.; Kamat, P. V. *Got TiO₂ Nanotubes? Lithium Ion Intercalation can Boost Their Photoelectrochemical Performance Three-Fold*. **ACS Nano** 2009, 3, 3437–3446. (<http://dx.doi.org/10.1021/nn900897r>)

PROFESSIONAL PRESENTATIONS (MOST RECENT FIRST)

1. M. Gupta, Z. Peng, **B. Meekins**, “Efficient Hydrogen Separation from MCH Dehydrogenation (Toluene + 3H₂) Using PA-doped PBI Membranes,” ECS Fall Meeting 2025, Chicago, IL.
2. L. Aguilar, O. Felix, K. Likit-anurak, S. Shimpalee, **B. Meekins**, “Direct Seawater Electrolysis,” GSSM Summer Poster Session 2025, Columbia, SC.
3. S. Costantino, I. Karki, B. Benicewicz, **B. Meekins**, “Effects of Acid Doping Concentration and Time on PBI Membrane Properties,” Summer Research Symposium 2025, Columbia, SC.
4. S. Rath, K. Likit-anurak, S. Shimpalee, **B. Meekins**, “Development of Catalyst Inks for PBI-Based CCMs,” Summer Research Symposium 2025, Columbia, SC.
5. I. Karki, B. Benicewicz, **B. Meekins**, “Mechanically Robust Dense PBI Membranes for High Power Density,” European Fuel Cell Forum 2025, Lucerne, Switzerland.
6. B. Benicewicz, I. Karki, H. Lin, K. Likit-anurak, **B. Meekins**, “Polybenzimidazole Membranes for Heavy Duty Transportation,” European Fuel Cell Forum 2025, Lucerne, Switzerland.
7. C. Tiller, O. Felix, K. Likit-anurak, S. Shimpalee, **B. Meekins**, “Direct Seawater Electrolysis,” Discover USC 2025, Columbia, SC.
8. M. Alvarez, D. Shah, K. Likit-anurak, **B. Meekins**, S. Shimpalee, “Anhydrous Polybenzimidazole-Based CO₂ Electrolysis Using Computational Fluid Dynamics,” AIChE Fall Meeting, Oct. 27-31, 2024, San Diego, CA.
9. O. Felix, S. Shimpalee, **B. Meekins**, “Technoeconomic Analysis and Comparison of PBI-Based Aqueous and Anhydrous HCl Electrolysis Processes”, Abstract #I01F-3222, PRiME 2024, Oct. 6-11, 2024, Honolulu, HI.
10. K. Likit-anurak, H. Teel, S. Shimpalee, **B. Meekins**, “Experimentally-Validated CFD Model of an Anhydrous HCl Electrolyzer”, Abstract #I01E-3202, PRiME 2024, Oct. 6-11, 2024, Honolulu, HI.
11. K. Likit-anurak, I. Karki, B. Howard, S. Shimpalee, B. Benicewicz, **B. Meekins**, “Polybenzimidazole Membranes for Waste Stream Remediation to High Value Products,” Abstract # L01-2420, 245th ECS Meeting May 26-30, 2024, San Francisco, CA.

12. **B. Meekins**, K. Likit-anurak, I. Karki, B. Howard, S. Shimpalee, B. Benicewicz, "Polybenzimidazole Membranes for Waste Stream Remediation to High Value Products," USC ECS, Columbia, SC, Fall 2023. (Invited)
13. **B. Meekins**, K. Likit-anurak, I. Karki, B. Howard, S. Shimpalee, B. Benicewicz, "*para*-Polybenzimidazole (PBI) Membranes for Anhydrous and Aqueous Electrolysis of Hydrogen Chloride (HCl)," World Fuel Cell Conference, Irving, CA, Fall 2023. (Virtual)
14. K. Likit-anurak, N. Mukhin, J. Brannon, A. Hepstall, L. Murdock, B. Benicewicz, S. Shimpalee, **B. Meekins**, "Para-polybenzimidazole Membranes for HCl Electrolysis at High ($T < 160\text{ }^{\circ}\text{C}$) Temperatures," Abstract #I01F-1668, 242nd ECS Meeting, Oct. 9-13, 2022, Atlanta, GA.
15. K. Likit-anurak, R. White, L. Murdock, B. Benicewicz, S. Shimpalee, **B. Meekins**, "Effect of Temperature on Anhydrous Hydrogen Chloride Electrolysis," 240th ECS Meeting, Oct. 10-14, 2021, Virtual.
16. G. Tate, B. Mehrabadi, W. Xiong, F. Rahman, **B. Meekins**, W. Diao, J. Regalbuto, J. Monnier, "Continuous Co-Electroless Deposition, an Improved Bimetallic Synthesis Method," Abstract #24541, 17th International Congress on Catalysis, June 14-19, 2020, San Diego, CA.
17. K. Likit-anurak, M. Brizes, J. Lopata, L. Murdock, J. Weidner, B. Benicewicz, S. Shimpalee, **B. Meekins**, "Gas Phase Electrolysis of Anhydrous HCl for Dry H_2 Production," Abstract #I01F-2493, PRiME 2020, Oct. 4-9, 2020, Virtual.
18. **B. Meekins**, A. Kennedy. "Photoelectrochemistry of $\text{Ga}_x\text{Zn}_{1-x}\text{O}_y\text{N}_{1-y}/\text{TiO}_2$ Heterostructures," AIChE Fall Meeting, Orlando, FL, Fall 2019
19. **B. Meekins**, G. Tate, W. Xiong, J. Weidner, J. Monnier. "Co-Electroless Deposition of Pt-M Bimetallic Alloyed Catalysts for Methanol Oxidation," ECS Fall Conference, Atlanta, GA, Fall 2019
20. **B. Meekins**. "Combustion Synthesis and Characterization of $\text{Ga}_x\text{Zn}_{1-x}\text{O}_y\text{N}_{1-y}$," AIChE 2018 Fall Meeting, Pittsburgh, PA, Fall 2018
21. **B. Meekins**, "Low Temperature Synthesis and Photoelectrochemical Characterization of GaZnON" Center for Electrochemistry Conference, Austin, TX, Spring 2016
22. **B. Meekins**, "Power and Remediation with Photovoltaics," AIChE Fall Conference, Atlanta, GA, Fall 2014
23. **B. Meekins**, P. V. Kamat, "The Role of Water Oxidation Catalyst IrO_2 in Shuttling Photogenerated Holes Across TiO_2 Interface," International Symposium on Clusters and Nanostructures, Richmond, VA, Nov. 6-10, 2011
24. **B. Meekins**, P. V. Kamat, "Enhanced Photovoltaic Properties of SrTiO_3 - TiO_2 Heterostructures for Solar Cell and Hydrogen Generation Applications" Graduate Student Union Symposium, Notre Dame, IN, Spring 2011.
25. **B. Meekins**, P. V. Kamat, "Amplification of Photocurrent Generation in Lithium Ion Intercalated TiO_2 Nanotube Arrays" Materials Research Society Fall Meeting, Boston, MA, Fall 2009.
26. **B. Meekins**, P. V. Kamat, " TiO_2 Nanotube-Gold Arrays for Hydrogen Generation" Graduate Student Union Symposium, Notre Dame, IN, Spring 2009.

FUNDING

1. "JTEKT/Celadyne/SC-Fraunhofer Alliance: Bipolar Plate Manufacturing for Water Electrolyzers", funded by the SC/Fraunhofer Alliance (2024 – 2026, \$520,000 / \$185,000 to USC). PI
2. "TRISO Recycling or Waste Reduction Using SRNL Vapor Digestion Technology", funded by Savannah River National Laboratory (2024 – 2026, \$1,500,000 / \$400,000 to USC). Co-PI
3. "Direct Electrolysis of Seawater Using PBI Membranes," funded by Office of Naval Research (07/24 – 07/27, \$615,000). PI
4. "Establishment of a Vertically Integrated Domestic Manufacturing Process for Production of Nonwoven Carbon Papers Substrates Needed for Gas Diffusion Layers", funded by Department of Energy (2024 – 2025, \$10,000,000 / \$458,000 to USC). Co-PI
5. "Durable Proton Conducting PBI Membranes for Hydrogen Applications", funded by BASF (2024 – 2027, \$999,962). Co-PI
6. "Industrial-Scale Bipolar Plate Coatings for Anti-Corrosion Properties in Fuel Cells", funded by DoE through SBIR Phase 1 with Advanced Cooling Technologies (2023 – 2024, \$250,000 / \$66,000 to USC). PI
7. "Stress Testing of Fuel Cell MEAs for Heavy Duty Applications", funded by Hyzon Motors (2023 – 2024, \$50,000). PI
8. "Ionomer and Membrane Testing," funded by Nissan Chemical Corporation and Paradigm Energy (2022 – 2024, \$36,000). PI
9. "Novel Dense-PBI Membranes for Photoelectrochemical Hydrogen Generation", funded by DoE through the SBIR Phase 1 program with Greenway Energy (2022 – 2023, \$250,000 / \$66,000 to USC). PI
10. "Membrane and Additive Testing", funded by Lubrizol Corporation (2021 – 2022, \$120,000). PI
11. "Evaluation of a New Process for a Highly Durable Proton Conducting PBI Membrane", funded by BASF (2021 – 2024, \$523,611). Co-PI
12. "Selective Continuous Flow Electrocatalytic Oxidation of Alkenes", funded by CeRCaS (2020 – 2021, \$60,000 / \$40,000 to USC). PI
13. "Nuvera Fuel Cells Leachate Testing," (2019 – present, \$57,778 total to USC). PI
14. "Project 21: Macroscopic monolithic Pd/Graphene catalysts for regioselective electrochemical oxidation of alkenes," (2019 – 2020, \$60,000 / \$18,000 to USC). Co-PI
15. "High Throughput Combinatorial Screening of Metal Nitrides, Metal Oxynitrides, and Metal Oxsulfides for Solar Fuel Conversions," (2019, \$10,000). PI

SUPERVISED STUDENTS

Undergraduate:

1. Austin Carver – 2017
2. Sadanan Boochakiat – 2017 (REU)
3. Austin Kennedy – 2017-2019
4. Witt Bauknight – 2018-2019
5. Varsha Gopal – 2018-2019
6. Hailey Boyer – 2018-2019

7. John Weiss – 2018-2021
8. Thomas Ballard – 2019
9. Michael Brizes – 2020
10. Rembert White – 2020-2021
11. Jamie Brannon – 2020-2022
12. Nikolai Mukhin – 2020-2022
13. Aubrey Hepstall – 2021-2023
14. Brandon Naumann – 2022 (REU)
15. Stella Le Mehaute – 2022 (Governor's School)
16. Bridgett Young – 2022
17. Joshua Sills – 2022
18. Grace Owen – 2022-2023
19. Emily Carpenter – 2023-2024
20. Dhairya Shah – 2023-2024
21. Joshua Blatt – 2023 (REU)
22. Sarah Fakult – 2022-2023
23. Ainsley Reed – 2023-present
24. Aidan Farrell – 2023-2025
25. Caroline Tiller – 2024-present
26. Dominique Smith – 2024-present
27. Mia Alvarez – 2024 (REU)
28. Tierney McCarroll – 2024 (REU)
29. Riley Goodwin – 2024-present
30. Sam Costantino – 2025-present
31. Saryu Rath – 2025-present
32. Liam Aguilar – 2025 (Governor's School)
33. Bryce Hitchler – 2025-present
34. Carter Stiglic – 2026-present

Graduate:

1. Kris Likit-anurak – 2019-2024
2. Mahsa Bagi – 2022-2023
3. Olusegun Felix – 2024-present
4. Dhairya Shah – 2024-present
5. Fethi Cimen – 2024-2025
6. Chantip (James) Dejakorn – 2025-present
7. Phuree (Barry) Fongsamootr – 2025-present

Postdoctoral Researchers:

1. Kris Likit-anurak – 2024-present

PATENTS

1. **B. Meekins**, B. Benicewicz, O. Felix, “A Method for Direct Electrolysis of Seawater using Polybenzimidazole-Based Devices,” Disclosure Submitted April 2, 2026.
2. **B. Meekins**, B. Benicewicz, K. Likit-anurak, “A Method for Production of Catalyst-Coated Acid-Doped Polybenzimidazole Membranes,” Disclosure Submitted October 18, 2025.
3. G. Tate, W. Xiong, **B. Meekins**, J. Monnier, “Co-Electroless Deposition Methods for Formation of Methanol Fuel Cell Catalysts,” US Patent 11,631,876 B2, April 18, 2023.
4. L. Murdock, K. Likit-anurak, **B. Meekins**, S. Shimpalee, B. Benicewicz, “Co-Generation of High Purity Hydrogen and Halide Gases by Electrolysis,” Application PCT/US2021/048782, September 2, 2021.
5. E. Sasmaz, N. Cordonnier, **B. Meekins**, J. Naglic, “Synthesis of Metal Oxynitrides Using Flame Spray Pyrolysis,” US Patent Application US 2020/0399126 A1, December 24, 2020.

SESSION CHAIR AT CONFERENCE

1. AIChE 2018 Fall Meeting, Oct. 28 – Nov. 2, 2018, Pittsburgh, PA.
2. AIChE 2019 Fall Meeting, Nov. 10 – 15, 2018, Orlando, FL.

JOURNAL REFEREE/REVIEWER

1. Journal of Physical Chemistry Letters
2. Sustainable Energy & Fuels
3. Surface Science Spectra
4. Journal of the Electrochemical Society
5. Journal of Physical Chemistry
6. Industrial and Engineering Chemistry Research
7. Environmental Science and Pollution Research International
8. Energy Conversion and Management
9. Electrochimica Acta
10. ACS Applied Energy Materials
11. International Journal of Hydrogen Energy

RECENT COLLABORATIONS

Profs. Sirivatch Shimpalee, Zhenmeng Peng, Brian Benicewicz and Drs. Laura Murdock, Ishwor Karki, and Ben Howard (USC), Drs. Hector Colón-Mercado, Prabhu Ganesan, and Maximilian Gorenssek, Dr. Cy Fujimoto (Sandia National Laboratory), Aaron Lando (Johnson Energy Solutions), Dr. Noah D. Meeks (Southern Company), Dr. Scott Mauger (National Renewable Energy Laboratory), Carsten Henschel and Joerg Belack (BASF), Dr. Rajesh Bashyam (Hyzon Motors), James “Jim” DiMento and Bryan Giard (Nuvera Fuel Cells), Makoto “Max” Wakabayashi (Nissan Chemical Corporation), Ryo Tamaki (Paradigm Energy), Prof. John Weidner (USC / Univ. of Cincinnati), Dr. Claudio Corgnale (CC Energy Consulting), Tyler Petek, Simon Crane, and Chris Rasik (Lubrizol Corporation), Lance Ferguson (JTEKT Corporation), Mruthunjaya “Jay” Uddi (Advanced Cooling Technologies)

POPULAR PRESS

Weekly Outreach “Open Science Presentations” (https://www.twitch.tv/open_science), May 2020-present

Narrated Presentation “The Role of IrO₂ in Mediating Hole Transfer at the TiO₂ Interface” (<http://youtu.be/okO2ZhKVpb4>), 2011.

Scivee TV Video Perspective “Tailored TiO₂-SrTiO₃ Heterostructure Nanotube Arrays for Improved Photoelectrochemical Performance” (<http://www.scivee.tv/node/27601>), 2011.

TEACHING

ECHE 322 – Mass Transfer **Spring 2024-2026**
Teach students core fundamentals of mass transfer, including transport phenomena of gases and liquids. Led 2 TAs.

CH 153K/154K – Physical Chemistry Lab **6/2015-7/2016**
Directed and overhauled the lab courses, converting them from 3 week experiment cycles to 2 week experiment cycles with 1 week for experiment reruns and journal-style lab report writing. Troubleshot eight experiments, led up to 8 TAs, and taught students best practices for both conducting experiments and compiling and discussing generated data in journal-style lab reports.

CH153K/154K – Physical Chemistry Lab (Drs. Wilson and Campion) **Spring 2015**
Floated between eight experiments, guiding students and answering questions about both laboratory procedure and theory

CH 320N – Organic Chemistry (Dr. Colapret) **Spring 2015**
Held office hours; proctored and graded monthly and final exams

Private Tutoring **2014-2016**
Provided private tutoring in chemistry and math.

CBE 40498 – Energy and Climate (Dr. Kuczenski) **Spring 2009**
Head TA – Performed all grading of assignments and exams and provided office hours weekly for both homework and test preparation help.

CBE 30361 – Materials Science (Dr. Mukasyan) **Fall 2008**
Head TA – Oversaw division of grading duties to two 1st-year TAs for both assignments and tests for 100+ student class and answered all questions about grading. Helped administer and monitor exams. Provided weekly office hours for questions about homework or upcoming tests.

CBE 30356 – Transport Phenomena II (Dr. Zhu) **Spring 2008**
Graded turned-in assignments and tests in a timely fashion and helped answer questions from students about grading.

CBE 31358 – Chem. Engr. Lab I (Dr. Saddawi)

Fall 2007

Guided students through experiments in (1) conversion of methane over palladium catalysts, (2) fermentation of sugar by microbes, and (3) particle flow generated by heat in a viscous fluid.

Teaching Workshops Attended

- *Promoting Critical Thinking in the Classroom*
- *Mentoring Undergraduate Research*
- *Grading Oral and Written Work*
- *Presentation Zen*
- *Keeping Students Engaged in Class*

PROFESSIONAL AND HONOR SOCIETIES

- Tau Beta Pi
- American Institute of Chemical Engineers
- American Chemical Society
- Electrochemical Society

AWARDS

- Sustainable Energy Initiative (SEI) Fellowship, University of Notre Dame (2010-2011)
- Rothberg Scholar, University of South Carolina Department of Chemical Engineering (2003-2007)
- South Carolina Palmetto Fellows Scholar (2003-2007)