

# Daniel V. Esposito

---

500 W. 120th St., Mudd 801, New York, NY 10027

Website: <https://solarfuelsengineering.com/>

de2300@columbia.edu

---

## EDUCATION

- Postdoctoral Fellowship** 2012-2014  
National Institute of Standards and Technology, Gaithersburg, MD  
National Research Council (NRC) Fellowship Program
- Ph.D., Chemical Engineering** Jan. 2012  
University of Delaware, Newark DE  
Solar Hydrogen NSF IGERT Program
- B.S., Chemical Engineering** May 2006  
Lehigh University, Bethlehem PA  
Graduated Tau Beta Pi, and with institutional honors

## PROFESSIONAL EXPERIENCE

- Associate Professor** 2019-present  
Department of Chemical Engineering, Columbia University, New York, NY
- Advisor** July-Dec. 2022  
sHYp, BV PBC, Wilmington, DE
- Assistant Professor** 2014-2018  
Department of Chemical Engineering, Columbia University, New York, NY

## RESEARCH INTERESTS

- **Electrocatalytic and photocatalytic materials**
  - Electrocatalysts and photocatalysts for conversion of H<sub>2</sub>O and CO<sub>2</sub> to energy dense fuels.
  - Electrocatalysis and photocatalysis at buried interfaces
  - Electrocatalyst design, synthesis, and characterization
  - Electroanalytical techniques to study interfacial charge transfer phenomena
- **Electrolyzers and photoelectrochemical devices**
  - Membraneless electrochemical and photoelectrochemical cells
  - Photovoltaic (PV)-electrolysis reactors
  - Polymer electrolyte membrane (PEM) and alkaline electrolyzers
  - Fuel cells
  - Understanding and controlling bubble dynamics in (photo)electrochemical reactors
- ***in-situ* imaging of PEC, PV, and catalytic materials and devices**
  - Scanning electrochemical microscopy (SECM)
  - Non-local scanning probes for high areal scan rates and high throughput screening of materials
  - Scanning photocurrent microscopy (SPCM)
  - High speed video analysis of operating electrochemical cells
  - Spectroelectrochemistry

## PUBLICATIONS

### Peer Reviewed Articles (since start of DVE's independent research career in 2014)

Note: articles are listed in reverse chronological order, with (\*) indicating corresponding author.

Note: many of our research articles involve the use of custom test cells or devices. Design files (.stl) for any/all cells used as a part of published research are made freely available for download at: [http://echem.io/AM\\_design\\_files](http://echem.io/AM_design_files)

1. M.E.S. Beatty, M. Herring, N.H. Llewellyn, L.A. Cohen, A.T. Haley, Z. Lin, M.A. Modestino, **D.V. Esposito\***, "Trends in Alcohol Oxidation Activity Enhancement for Tunable Silicon Oxide Encapsulated Platinum Electrocatalysts", Preprint available [here](#).
2. L.A. Cohen, M.S. Weimer, K. Yim, J. Jin, D.V. Fraga Alvarez, A.A. Dameron, C.B. Capuano, R.J. Ouimet, S. Fortiner, **D.V. Esposito\***, "How Low can you Go? Nanoscale Membranes for Efficient Water Electrolysis", *ACS Energy Letters*, (Accepted). Preprint available [here](#).
3. W.D.H. Stinson, R.S. Stinson, J. Jin, Z. Chen, M. Xu, F. Aydin, Y. Wang, M.F. Calegari Andrades, X. Pan, T.A. Pham, K.E. Hurst, T. Ogitsu, S. Ardo, **D.V. Esposito\***, "Probing the Active Sites of Oxide Encapsulated Electrocatalysts with Controllable Oxygen Evolution Selectivity". Preprint available [here](#).
4. D. Fraga Alvarez, Z. Lin, Z. Shi, A.F. Baxter, E.E. Wang, D. Kuvar, N. Mahmud, M.E. El-Naas, H.D. Abruna, D.A. Muller, **D.V. Esposito\***, "Condensed Layer Deposition of Nanoscopic TiO<sub>2</sub> Overlayers on High Surface Area Electrocatalysts". Preprint available [here](#).
5. A. Badreldin, A. El Ghenemy, A. Al-Zubi, A. Ashour, N. Hassan, A. Prakash, M. Kozusznik, **D.V. Esposito**, S. UI. Solim, A. Abdel-Wahab, "Stepwise Strategies for Overcoming Limitations of Membraneless Electrolysis for Direct Seawater Electrolysis", *Journal of Power Sources*, 2024, 593, 233991. Download [here](#).
6. D. Fraga Alvarez, D. Livitz, X. Pang, N. Mahmud, K.J.M. Bishop, M. H. El-Naas, **D.V. Esposito\***, "Alkalinity Enhancement During Reject Brine Electrolysis: Role of Electrocatalyst Placement on the Outer Surfaces of Porous Flow-through Electrodes". *ACS Sustainable Chemistry & Engineering*, 2023, 11, 15620, Download [here](#).
7. M. J. Ginsberg, **D.V. Esposito\***, V. M. Fthenakis, "Designing Off-Grid Green Hydrogen Plants Using Dynamic Polymer Electrolyte Membrane Electrolyzers to Minimize the Hydrogen Production Cost". *Cell Reports Physical Science*, 2023, 4 (10), 101625. Download [here](#).
8. A. Baxter, J. Abed, D. Fraga Alvarez, D. Zhou, T. Sargent, **D. V. Esposito\***, "Nanoscopic Silicon Oxide Overlayers Improve the Performance of Ruthenium Oxide Electrocatalysts Towards the Oxygen Evolution Reaction". *Journal of Electrochemical Society*, 2023, 170 054503. Download [here](#)
9. S. He, S. Okuno, F. W. Ng, X. Pang, D. V. Esposito, N. M. Orchanian, M. L. Steigerwald, X. Roy, C. Nuckolls, "Functional Monolayers on a Superatomic Pegboard", *Journal of the American Chemical Society*, 145 (15), 8314-8318. Download [here](#).
10. B. Zutter, Z. Chen, L. Barrera, W. Gaieck, A. S. Lapp, K. Watanabe, A. Kudo, **D. V. Esposito**, R. Bala Chandran, S. Ardo, A. Alec Talin, "Single-Particle Measurements Reveal the Origin of Low Solar-to-Hydrogen Efficiency of Rh-Doped SrTiO<sub>3</sub> Photocatalysts", *ACS Nano*, 2023, 17, 10, 9405–9414. Download [here](#).
11. F. Aydin, M. F. Andrade, R. S. Stinson, A. Zagalskaya, D. Schwalbe-Oda, Z. Chen, S. Sharma, A. Maiti, **D.V. Esposito**, S. Ardo, T. Pham, T. Ogitsu, "Mechanistic Insights on Permeation of Water over Iron Cations in Nanoporous Silicon Oxide Films for Selective H<sub>2</sub> and O<sub>2</sub> Evolution", *ACS Applied Materials & Interfaces*, 2023, 15 (14), P17814-17824. Download [here](#).
12. D. S. Mallapragada,\* Y. Dvorkin,\* M. Modestino,\* **D. V. Esposito**, W. Smith, B. Hodge, M. P. Harold, V. M. Donnelly, A. Nuz, C. Bloomquist, K. Baker, L. C. Grabow, Y. Yan, N. N. Rajput, R. Hartman, E. J. Biddinger, E. Aydil, A. Taylor, "Decarbonization of the Chemical Industry through Electrification: Barriers and Opportunities", *Joule*, 2023, 7 (1), P23-41. Download [here](#).
13. W. Stinson, K. Brayton, S. Ardo, A. Alec Talin, **D. V. Esposito\***, "Quantifying the Influence of Defects on Selectivity of Electrodes Encapsulated by Nanoscopic Silicon Oxide Overlayers", 2022, 14 (50), pp. 55480-55490. Download [here](#).
14. X. Pang, S. Verma, G. Liu, **D. V. Esposito\***, "Membrane-free Electrochemical CO<sub>2</sub> Conversion using Serially-Connected Porous Flow-Through Electrodes". *Joule*, 2022, 6 (12), P2745-2761. Download [here](#).

15. J. Vos, A. Bhardwaj, A. Jeremiase, **D. V. Esposito**, M. Koper\*, “Probing the Effects of Electrode Composition and Morphology on the Effectiveness of Silicon Oxide Overlayers to Enhance Selective Oxygen Evolution in the Presence of Chloride Ions”, *126 (48)*, pp. 20314-20325, 2022. Download [here](#).
16. N. Mahmud, M. H. Ibrahim, D. V. Fraga Alvarez, **D. V. Esposito**\*, M. H. El-Naas\* “Evaluation of parameters controlling calcium recovery and CO<sub>2</sub> uptake from desalination reject brine: An optimization approach”, *Journal of Cleaner Production*, vol. 369 (1), 133405, 2022.
17. M. J. Ginsberg, M. Venkatraman, **D.V. Esposito**\*, V. M. Fthenakis\*, “Minimizing the cost of hydrogen production through dynamic polymer electrolyte membrane electrolyzer operation”. *Cell Reports Physical Science*, vol. 3, 100935, 2022. Download [here](#).
18. P. Badjatya, A. Akca, D. Fraga Alvarez, B. Chang, S. Ma, X. Pang, E. Wang, Q. Van Hinsberg, **D.V. Esposito**\*, S. Kawashima\*, “Carbon-Negative Cement Manufacturing from Seawater-Derived Magnesium Feedstocks”. *Proceedings of the National Academy of Sciences of the United States of America*, 119 (34) e2114680119, 2022.
19. A.H. Akca, S. Ma, **D.V. Esposito**, S. Kawshima, “Evaluation of Mechanical Performance of Compacted Magnesium Hydroxide after Carbonation Curing”. *Journal of Materials in Civil Engineering*, 34 (5), 04022056, 2022. Download [here](#).
20. N. Mahmud, D.V. Fraga Alvarez, M.H. Ibrahim, M.H. El-Naas\*, **D.V. Esposito**\*, “Magnesium recovery from desalination reject brine as pretreatment for membraneless electrolysis”. *Desalination*, vol. 525, 115489, 2022. Download [here](#).
21. M. Ginsberg, Z. Zhang, A. A. Atia, M. Venkatraman, **D.V. Esposito**, V. M. Fthenakis, “Integrating Solar Energy, Desalination, and Electrolysis” *Sol. RRL*, 6: 2100732, 2022. Download [here](#).
22. X. Liu, B. Li, F. A. Soto, X. Li, R. R. Unocic, P. B. Balbuena, A. R. Harutyunyan\*, J. Hone\*, **D. V. Esposito**\*, “Enhancing Hydrogen Evolution Activity of Monolayer Molybdenum Disulfide via a Molecular Proton Mediator”. *ACS Catalysis*, 11, 12159–12169, 2021.
23. A. E. Dorfi, J. Yan, J. Wright\*, **D.V. Esposito**\*, “Compressed Sensing Image Reconstruction of Scanning Electrochemical Microscopy Measurements Carried Out at Ultrahigh Scan Speeds Using Continuous Line Probes”. *Anal. Chem.*, 93, 37, 12574–12581, 2021.
24. A. Bhardwaj, J. Vos, M. Beatty, A.F. Baxter, M. Koper, N. Y. Yip, **D.V. Esposito**\*, “Silicon Oxide-Encapsulated Electrocatalysts for Selective Oxygen Evolution in Chloride-Containing Electrolytes”. *ACS Catalysis*, 11, 1316–1330, 2021. Download [here](#).
25. M.S. Beatty, A. Haley, E. Gillette, **D.V. Esposito**\*, “Controlling Proton and Oxygen Fluxes to Electrocatalytic Buried Interfaces by Tuning the Composition of Ultrathin Silicon Oxide Overlayers.” *ACS Applied Energy Materials*, vol. 3, 12, 12338-12350, 2020. Download [here](#).
26. X. Pang, S. Das, J. Davis, A. Harvey, **D.V. Esposito**\*, “Framework for evaluating the performance limits of membraneless electrolyzers”. *Energy & Environmental Science*, vol. 13, 3663-3678, 2020. Download [here](#).
27. S. Ma, A. H. Akca, **D.V. Esposito**, S. Kawashima, “Influence of aqueous carbonate species on the hydration and carbonation behavior of reactive MgO cement”. *J. CO2 Utilization*, vol. 41, 101260, 2020. Download [here](#).
28. A. E. Dorfi, S. Zhou, A.C. West, J. Wright, **D.V. Esposito**\*, “Probing the Speed Limits of Scanning Electrochemical Microscopy with In situ Colorimetric Imaging”. *ChemElectroChem*, vol. 7, 2424-2432, 2020. Download [here](#).
29. Mark T. Spitler, et al., “Practical Challenges in the Development of Photoelectrochemical Solar Fuels Production”. *Sustainable Energy & Fuels* (2020). vol 4, 985-995, 2020. Download [here](#).
30. J.C. Bui, J.T. Davis, **D.V. Esposito**\*, “3D Printed Clickable Membraneless Electrode Assemblies for Water Electrolysis”. *Sustainable Energy & Fuels*, vol. 4, 213-225, 2020. Download [here](#).
31. Y. Liu, H. You, Y. Kimmel, **D.V. Esposito**, J.G. Chen, T.P. Moffat, “Self-terminating Electrodeposition of Pt on WC Electrocatalysts”. *Applied Surface Science*, vol. 28, 144472, 2020. Download [here](#).
32. X. Liu, B. Li, X. Li, A. Harutyunyan, J. Hone\*, **D.V. Esposito**\*, “The Critical Role of Electrolyte Gating on the Performance of Monolayer MoS<sub>2</sub> Electrocatalysts”. *Nano Letters*, vol. 19, 11, 8118-8124, 2019. Download [here](#).
33. A. E. Dorfi, H. Kuo, V. Smirnova, J. Wright, **D.V. Esposito**\*, “Scanning Electrochemical Microscope for High Throughput Imaging with Continuous Line Probes”. *Review of Scientific Instruments*, vol. 90, pp 083702, 2019. NSF highlight. Download [here](#).
34. J. Davis, D. Brown, X. Pang **D.V. Esposito**\*, “High Speed Video Investigation of Bubble Dynamics and Current Density Distributions in Membraneless Electrolyzers”. *Journal of the Electrochemical Society*, vol. 166 (4), pp F312-F321, 2019. Download [here](#).

35. N. Labrador, J. Robinson, B. Xu, B. Sartor, **D.V. Esposito\***, “Silicon Oxide-Encapsulated Platinum Thin Films as Highly Active Electrocatalysts for Carbon Monoxide and Methanol Oxidation”. *ACS Catalysis*, vol. 8, pp 11423–11434, 2018. Download [here](#).
36. M. Beatty, H. Chen, B. Lee, N. Labrador, **D.V. Esposito\***, “Structure-Property Relationships Describing the Buried Interface Between Silicon Oxide Overlayers and Electrocatalytic Platinum Thin Films”. *Journal of Materials Chemistry A*, vol. 6, pp 22287-22300, 2018. Download [here](#). (**Emerging Investigators 2018 Issue**)
37. G.D. O’Neil, H. Kuo, D. Lomax, J. Wright\*, **D.V. Esposito\***, “Scanning Electrochemical Microscopy: Beyond the Point Probe”, *Analytical Chemistry*, vol. 90 (19), pp 11531–11537, 2018. Download [here](#).
38. A. M. Dadgar, D. Scullion, K. Kang, **D. Esposito**, E. H. Yang, I. P. Herman, M. A. Pimenta, E.-J. G. Santos, and A. N. Pasupathy , “Strain Engineering and Raman Spectroscopy of Monolayer Transition Metal Dichalcogenides”, *Chemistry of Materials*, vol. 30 (15) pp 5148-5155. Download [here](#).
39. N. Y. Labrador, E. L. Songcuan, C. De Silva, Han Chen, Sophia Kurdziel, Ranjith K. Ramachandran, Christophe Detavernier, **D.V. Esposito\***, “Hydrogen Evolution at the Buried Interface between Pt Thin Films and Silicon Oxide Nanomembranes”. *ACS Catalysis*, vol. 8, pp 1767–1778, 2018. Download [here](#).
40. **D.V. Esposito\***, “Membrane Coated Electrocatalysts—an Alternative Approach to Achieving Stable and Tunable Electrocatalysis”. *ACS Catalysis*, vol. 8, pp 457–465, (2018). Download [here](#) .
41. J.T. Davis, J. Qi, X. Fan, J. Bui, **D.V. Esposito\***, “Floating Membraneless PV-Electrolyzer Based on Buoyancy-Driven Product Separation”, *International Journal of Hydrogen Energy*, vol. 43 (3), pp 1224–1238, (2018). **Highlighted in Newsweek, Smithsonian.com, NBC News, Materials World, and more.**
42. A. E. Dorfi, A.C. West, **D.V. Esposito\***, “Quantifying Losses in Photoelectrode Performance due to Single Hydrogen Bubbles”, *Journal Physical Chemistry C.*, vol. 121 (48), pp 26587–26597, (2017). Download [here](#).
43. **D.V. Esposito\***, “Membraneless Electrolyzers for Low-Cost Hydrogen Production in a Renewable Energy Future”. *Joule*, 1, 1-8, (2017). Download [here](#). (Invited Perspective article)
44. O.O. Talabi, A.E. Dorfi, G.D. O’Neil, **D.V. Esposito\***, “Membraneless Electrolyzers for the Simultaneous Production of Acid and Base”. *Chemical Communications*, **53**, 8006-8009 2017. Part of the 2017 Emerging Investigators Issue. Download [here](#).
45. **D.V. Esposito\***, Y. Lee, N.Y. Labrador, H. Yoon, P. Haney, A.A. Talin, V. Szalai, T.P. Moffat, “Deconvoluting the Influences of 3-D Structure on the Performance of Photoelectrodes for Solar-Driven Water Splitting”. *Sustainable Energy & Fuels*, 1, 154-173, (2017). Download [here](#).
46. J.T. Davis, **D.V. Esposito\***, “Limiting Photocurrent Analysis of a Wide Channel Photoelectrochemical Flow Reactor”, *Journal of Physics D: Applied Physics.*, vol. 50, 8, 11 pp, (2017). (Special Issue on Solar Fuels). Download [here](#)
47. N. Y. Labrador, X. Li, Y. Liu, J. T. Koberstein, R. Wang, H. Tan, T. P. Moffat, **D. V. Esposito\***, “Enhanced Performance of Si MIS Photocathodes Containing Oxide-Coated Nanoparticle Electrocatalysts”. *Nano Letters*, 16, 6452-6459, (2016).
48. G.D. O’Neil, C. Christian, D. Brown, J.T. Davis, D.E. Brown, **D.V. Esposito\***, “A Simple and Scalable Membraneless Electrolyzer for Hydrogen Production from Water Electrolysis”. *J. Electrochemical Society*, vol. 163 (11) F3012-F3019 (2016). (JES Focus Issue on Electrolysis for Increased Renewable Energy Penetration).
49. **D.V. Esposito\***, J.B. Baxter, J. John, N.S. Lewis, T.P. Moffat, T. Ogitsu, G.D. O’Neil, T.A. Pham, A.A. Talin, J.M. Velazquez, B.C. Wood. “Methods of Photoelectrode Characterization with High Spatial and Temporal Resolution.” *Energy & Environmental Science*. vol. 8, 2863-2885, (2015).
50. J. M. Velazquez, J. John, **D. V. Esposito**, A. Pieterick, R. A. Pala, G. Sun, X. Zhou, Z. Huang, S. Ardo, M. P. Soriaga, B. S. Brunshwig and N. Lewis. “A Scanning Probe Investigation of the Role of Surface Motifs in the Behavior of p-WSe<sub>2</sub> Photocathodes.” *Energy & Environmental Science*, 9, 164-175, (2015).

#### Peer Reviewed Articles from Postdoc and PhD Research:

51. **D.V. Esposito**, I. Levin, T.P. Moffat, and A.A. Talin. “Hydrogen Evolution at Si-based Metal-Insulator-Semiconductor Photoelectrodes Enhanced by Inversion Channel Charge Collection and Hydrogen Spillover.” *Nature Materials*, vol. 12, 562-568 (2013).
52. **D.V. Esposito**<sup>^</sup>, R.V Forest<sup>^</sup>, Y. Chang, N. Gaillard, B.E. McCandless, S. Hou, K.H. Lee, R.W. Birkmire, and J.G. Chen, “Photoelectrochemical Reforming of Glucose for Hydrogen Production using a WO<sub>3</sub>-based Tandem Cell Device”. *Energy & Environmental Science*, vol. 5, 9091-9099, 2012. <sup>^</sup>shared first authorship.

53. **D.V. Esposito**, S.T. Hunt, Y. Kimmel, and J.G. Chen, “A New Class of Electrocatalysts for Hydrogen Production from Water Electrolysis: Metal Monolayers Supported on Low-Cost Transition Metal Carbides”. *Journal of the American Chemical Society*, vol. 134, 3025-3033, 2012.
54. M. C. Weidman, **D.V. Esposito**, Y.C. Hsu, and J.G. Chen, “Comparison of Electrochemical Stability of Transition Metal Carbides (WC, W<sub>2</sub>C, Mo<sub>2</sub>C) Over a Wide pH Range”. *Journal of Power Sources*, vol. 202, 11-17, 2012.
55. Y. Kimmel, **D.V. Esposito**, R.W. Birkmire, and J.G. Chen, “Effect of Surface Carbon on the Hydrogen Evolution Reactivity of Tungsten Carbide (WC) and Pt-modified WC Electrocatalysts”. *International Journal of Hydrogen Energy*, vol. 37, 3019-3024, 2012.
56. **D.V. Esposito** and J.G. Chen, “Monolayer Platinum Supported on Tungsten Carbides as Low-Cost Electrocatalysts: Opportunities and Limitations”. *Energy & Environmental Science*, vol. 4, 3900-3912, 2011.
57. I.J. Hsu, **D.V. Esposito**, E. Mahoney, A. Black, and J.G. Chen, “Particle Shape Control using Pulse Electrodeposition: Methanol Oxidation as a Probe Reaction on Pt Dendrites and Cubes”. *Journal of Power Sources*, vol. 196, 8307-8312, 2011.
58. **D.V. Esposito**, Y. Chang, J.G. Chen, R.W. Birkmire, and N. Gaillard, “Hydrogen Production from Photo-driven Electrolysis of Biomass-derived Oxygenates: A Case Study on Methanol using Pt-modified WO<sub>3</sub> Thin Film Electrodes”. *International Journal of Hydrogen Energy*, vol. 36, 9632-9644, 2011.
59. **D.V. Esposito**, S.T. Hunt, A.L. Stottlemyer, K.D. Dobson, B.E. McCandless, R.W. Birkmire, and J.G. Chen, “Low-Cost Hydrogen Evolution Catalysts Based on Monolayer Platinum on Tungsten Monocarbide (WC) Substrates”. *Angewandte Chemie International Edition*, vol. 49, 9859-9862, 2010.
60. M. C. Weidman, **D.V. Esposito**, I.J. Hsu, and J.G. Chen, “Electrochemical Stability of Tungsten and Tungsten Monocarbide (WC) Over Wide pH and Potential Ranges”. *Journal of the Electrochemical Society*, vol. 157, F179-F188, 2010.
61. W. Y. Yin, **D.V. Esposito**, S. Yang, C. Ni, J. G. Chen, G. Zhao, Z. Zhang, C. Hu, M. Cao, and Bingqing Wei, “Controlling Novel Red-Light Emissions by Doping In<sub>2</sub>O<sub>3</sub> Nano/Microstructures with Interstitial Nitrogen”. *J. Phys. Chem. C*, vol. 114, 13234-13240, 2010.
62. **D.V. Esposito**, O.Y. Goue, K.D. Dobson, B.E. McCandless, J.G. Chen, and R.W. Birkmire, “A New Photoelectrochemical Test Cell and Its Use for a Combined Two- and Three-Electrode Approach to Cell Testing”. *Review of Scientific Instruments*, vol. 80, 125107, 2009.
63. **D.V. Esposito**, K.D. Dobson, B.E. McCandless, R.W. Birkmire, and J.G. Chen, “Comparative Study of Tungsten Monocarbide and Platinum as Counter Electrodes in Polysulfide-Based Photoelectrochemical Solar Cells”. *Journal of the Electrochemical Society*, vol. 156, pp. B962-B969, 2009.
64. E.C. Weigert, **D.V. Esposito**, and J.G. Chen, “Cyclic Voltammetry and XPS studies of Electrochemical Stability of Clean and Pt-Modified Tungsten and Molybdenum Carbide (WC and Mo<sub>2</sub>C) Films”. *Journal of Power Sources*, vol. 193, pp. 501-506, 2009.
65. J.M. Meacham, M.J. Varady, **D.V. Esposito**, F.L. Degertekin, and A.G. Fedorov, “Micromachined Ultrasonic Atomizer For Liquid Fuels”. *Atomization and Sprays*, vol. 18, pp. 163-190, 2008.

### Other Publications and Products:

1. **D.V. Esposito**, V. Giulimondi, J. Vos, M. T. M. Koper, “Design Principles for Oxide-Encapsulated Electrocatalysts”, book chapter in [Ultrathin Oxide Layers for Solar and Electrocatalytic Systems](#), Energy and Environment Series, Royal Society of Chemistry. ISSN: 2044-0774. DOI: 10.1039/9781839163708
2. **D.V. Esposito** and H. Frei, “[Outlook](#)“, book chapter in [Ultrathin Oxide Layers for Solar and Electrocatalytic Systems](#), Energy and Environment Series, Royal Society of Chemistry. DOI: 10.1039/9781839163708-00342, 2022.
3. Contributor to the 2019 DOE Basic Energy Sciences (BES) report “Research Opportunities for Liquid Solar Fuels” based on a BES-sponsored roundtable meeting on this topic that was held in August 2019 in Rockville, MD. Download report [here](#).
4. **D.V. Esposito** and D. Steingart, “[Additive Manufacturing and Electrochemistry](#)” ECS Interface, Vol. 25, Editorial published in Spring 2016 Special Issue of ECS Interface.
5. D. Steingart and **D.V. Esposito**, “Open Source Tools for Electrochemists”, website for online repository of 3D printer design files used for electrochemical science and applications. Available at: <http://echem.io/>

6. **D.V. Esposito** and V. Alt. “Estimating solar energy requirements to meet U.S. energy needs: an outreach event”, *NCSL International Workshop & Symposium Proceedings*, 2014.

**Patents:** 4 patents issued, 7 provisional patents filed

1. **D.V. Esposito**, “Electrolysis Cell Systems Including Proton Conducting Oxide Membranes”. (U.S. Patent Application No.: US2023 63/453,671)
2. **D.V. Esposito**, X. Pang, “Systems and Methods for Electrochemical CO<sub>2</sub> Conversion in Membraneless Electrolyzers”. (US Provisional patent Application US202363429665)
3. **D.V. Esposito**, L.F. Greenlee, “Systems and Methods for Electrochemical Generation of Acid and Base”. (US Provisional patent Application No. 63/439677, filed Jan. 2023).
4. S. Ardo, Z. Chen, **D.V. Esposito**, R. Bala Chandran, Z. Chen, J. M. Mayer, B. James, J. Huya-Kouadio, “Designs for Photocatalyst Suspension Reactors for Solar Fuel Formation”, (US Provisional patent Application No. 63/349442, filed June 2022).
5. X. Li, Av. Harutyunyan, X. Liu, B. Li, J. Hone, **D.V. Esposito**, “Catalyst Compositions Including Metal Chalcogenides, Processes for Forming the Catalyst Compositions, and Uses Thereof”, US. Patent No. 11,565,247 (IR# CU21120). Download [here](#).
6. **D.V. Esposito**, Q. van Hinsberg, “Membraneless Electrolyzers for the Production of Alkaline and Acidic Effluent Streams”, WO 2022/104242 A1. International Publication Date 19 May 2022.
7. S. Kawashima, **D.V. Esposito**, S. Ma, A.H. Akca, “METHODS AND SYSTEMS FOR PROVIDING IMPROVED CEMENT INCORPORATING METAL OXIDES AND HYDROXIDES”. (US. Patent Publication No. [20210188711](#)).
8. **D.V. Esposito**, X. Pang, S. Kawashima, “Systems and Methods for Membrane-Free Electrolysis”. (Patent application: [PCT/US2020024699](#) )
9. **D.V. Esposito**, J. Wright, G.D. O’Neil, H. Kuo, “Continuous Multi-Dimensional Scanning Probes (CMDPs) for Scanning Probe Microscopy” (Patent Application # 62/661,823 filed with USPTO)
10. **D.V. Esposito**, G.D. O’Neil, “Membraneless Electrochemical Flow-Through Reactor”. US Patent No. 2017/0081770 A1, 2017.
11. **D.V. Esposito**, A.A. Talin, and T.P. Moffat, “Photoactive article, process for making, and use of same”. US Patent No. 9,562,292, 2017.

#### **INVITED TALKS (Since joining Columbia; list excludes internal talks)**

1. ACerS MCARE conference, Symposium 5, Bellevue WA, August 2023.
2. ACerS MCARE conference, Symposium 3, Bellevue WA, August 2023.
3. Princeton University, Student ECS chapter seminar, Princeton, NJ, June 2023.
4. ECS Annual Spring Meeting, Boston MA, May 2023.
5. Georgia Tech, Chemical Engineering Dept., March 2023.
6. ECS Annual Fall Meeting, Symposium I04, Atlanta GA, October 2022.
7. ECS Annual Fall Meeting, Symposium F02, Atlanta GA, October 2022.
8. Columbia University – Tel Aviv University Engineering Research Symposium (Virtual), Oct. 2021.
9. ECS Annual Spring Meeting (Virtual), April 2021.
10. MRS Annual Spring Meeting (Virtual), April 2021.
11. Cornell University, Materials Science & Engineering Dept., March 2021.
12. Colorado School of Mines, Materials Science & Engineering Dept., February 2021.
13. University of Cantabria (Spain), Chemical Engineering Dept. November 2020.
14. Rutgers University, Materials Science & Engineering Dept., October 2020.
15. Lancaster University (UK) / Energy Lancaster, Virtual seminar, July 2020.
16. Global Virtual Meeting on Solar Fuels, organized through MaterialsOceania, June 2020.

17. Lablinks Carbon Capture and Conversion Workshop, Harvard, MA, October 2019.
18. Korea Advanced Institute of Technology (KAIST), Materials Science Dept., Sept. 2019.
19. Korea Institute of Technology (KIST), Clean Energy Research Center, Sept. 2019.
20. 7<sup>th</sup> International Workshop on Nanotechnology, Renewable Energy & Sustainability, Xi'an Jiaotong University, China, September 2019.
21. ACS national meeting, San Diego CA, August 2019.
22. E-MRS meeting in Nice, France, May 2019
23. Warwick University (UK), Chemistry department, May 2019.
24. MRS national meeting, Boston MA, November 2018.
25. Electricity-to-X workshop, Denver CO, Sept. 2018.
26. ACS Fall Meeting, Boston MA, Aug. 2018.
27. ECS Spring Meeting, Seattle WA, May 2018.
28. Technical University in Delft (TUD), Chemical Engineering Dept. seminar, May 2018.
29. KU Leuven (Belgium), Department of Microbial and Molecular Systems, May 2018.
30. Leiden University (Netherlands), Chemistry Dept., May 2018.
31. City College of New York (CCNY), Chemical Engineering Dept. seminar, Feb. 2018.
32. New Jersey Institute of Technology, Chemical Engineering Dept. seminar, Oct. 2017.
33. NanoGe Meeting, Solar Fuels Symposium, Barcelona, Spain, September 2017.
34. New York Catalysis Society Symposium, Clinton, NJ, March 2017.
35. University of Delaware, Center for Catalytic Science and Technology, March 2017.
36. University of Missouri, Chemical Engineering Department seminar, March 2017.
37. International Conference on Catalysis and Chemical Engineering, Baltimore, MD, February 2017.
38. Closing the Carbon Cycle Conference, Arizona State University, AZ, October 2016.
39. ACS MARM conference, Riverdale, NY, June 2016.
40. Workshop on Photovoltaic Electrolysis, University of Delaware, March 2016.
41. St. John's University, Chemistry Department, February 2016.
42. City University of New York (CUNY) Queens, Chemistry Department, December 2015.
43. ECS Fall Meeting, Phoenix AZ, October 2015.
44. SPIE Optics and Photonics Conference, San Diego CA, August 2015.
45. ECS Spring Meeting, Chicago, IL, May 2015.
46. ACS Spring Meeting, Denver, CO, March 2015.
47. Rochester Institute of Technology (RIT), School of Chemistry and Materials Science, March 2015, Rochester NY.
48. Gordon Research Conference on Electrodeposition, Biddeford ME, July 2014.

## TEACHING AND MENTORING

### Courses taught

- CHEN E4140, Engineering Separations (2023-present)
- CHEN E4330, Advanced Chemical Kinetics (2014-2020, 2023)
- CHEN E3810, Chemical Engineering Laboratory (2021)
- CHEN E4231, Solar Fuels (2016-2021, 2024-present)
- CHEN E9000, Chemical Engineering Colloquium (2015-2017)
- CHEN E9500, Doctoral Research (2015-present)
- CHEN E9400, Masters Research (2014-present)

- CHEN E3900, Undergraduate Research (2014-present)

### Experience as a mentor for PhD, postdoc, MS, and undergraduate student research

- **Doctoral students (sponsored):** (6 Ph.D. students graduated to date)

1. Natalie Labrador  
Thesis: “*Oxide-Encapsulated Electrocatalysts for Solar Fuels Production*”
2. Jonathan “Jack” Davis  
Thesis: “*Membraneless Electrolyzers for Solar Fuels Production*”
3. Anna Dorfi  
Thesis: “*In-situ Scanning Probe Techniques for Evaluation of Electrochemical Systems*”
4. Marissa Beatty  
Thesis: “*Design Rules for Membrane Coated Electrocatalysts*”
5. Xueqi Pang  
Thesis: “*Design Principles for Membraneless Electrolyzers for Production of Fuels and Chemicals*”

6. Daniela Fraga Alvarez  
Thesis: “*Bursting the Bubble: Membraneless Electrolyzers and High-Surface Oxide Coated Electrodes for Brine Management*”

7. William Stinson (current student)
8. Daniela Bushiri (current student)
9. Lucas Cohen (current student)
10. Patrick Aghadiuno (current student)
11. Jingjing Jin (current student)
12. Kevin Dunn (current student)

- **Doctoral students (reader and committee member):** 42

- **Postdoctoral researchers and associate research scientists:**

1. Glen O’Neil (faculty member at Montclair State U.)
2. Xiangye Liu (faculty member at Northwestern Polytechnic University, Xi’an)
3. Amanda Baxter
4. Kyungmin Yim
5. Zhexi Lin (postdoc: 2023, associate research scientist: 2024-present)
6. Jesse Dondapati

- **MS researchers:** 40

- **Undergraduate researchers:** 22

- **Highschool researchers:** 8

### AWARDS & HONORS

- 2020- Selected as one of 30 experts on solar fuels technology in the US and Germany to participate in recurring workshops on “Artificial Photosynthesis” organized jointly by the US DOE (BES) and German Federal Ministry of Education and Research (BMBF).
- 2018-NSF CAREER Award (CBET Catalysis program). See Columbia [press release](#).
- 2017-2018 [Scialog Fellow](#). Participated in multi-year interdisciplinary initiative on “Advanced Energy Storage” with peer fellows and senior facilitators recognized to be leaders in the field of electrochemical energy storage.
- 2018 Invited contributor to the *J. Materials Chemistry A*. Emerging Investigators Issue.
- 2017 Invited contributor to the *Chemical Communications* Emerging Investigators Issue.
- [NRC Postdoctoral Fellowship](#), National Institute of Standards and Technology National Research Council Postdoctoral Research Associateship Program-2011



- Fellowship, U. Delaware, [Bill N. Baron Fellowship Award](#)-2010
- Fellowship, U. Delaware, [NASA Delaware Space Grant College and Fellowship Program](#)-2008
- Fellowship, U. of Delaware, [Solar Hydrogen IGERT Program](#)-2006
- ACS Award for outstanding senior in Chemical Engineering at Lehigh University-2006
- Chandler Award for excellence in Chemical Engineering, Lehigh University – 2004

## PROFESSIONAL AFFILIATIONS

American Institute of Chemical Engineers, Electrochemical Society, International Society of Electrochemistry, American Chemical Society (CATL division member), Materials Research Society, Tau Beta Pi Engineering Honor Society

## PROFESSIONAL SERVICE

- **Proposal reviewer:** Served as a reviewer of grant proposals for the following funding agencies: DOE/EERE (4 times), NSF (9 times), NASA(1), AFOSR(1).
- **Peer reviewer, journals** (10-20 articles /year): Nature, Angewandte Chemie, Energy & Environmental Science, Joule, Nature Materials, PNAS, Nature Communications, PNAS, ACS Catalysis, J. American Chemical Society, Nature Catalysis, J. Physical Chemistry, J. Electrochemical Society, Electrochimica Acta, ACS Nano, Advanced Energy Materials, ChemPhysChem, J. Catalysis, Sustainable Energy & Fuels, Int. J. Hydrogen Energy, Applied Catalysis B, J. Power Sources, Rev. of Scientific Instruments, Scientific Reports, ACS Applied Materials & Interfaces, and more.
- Co-Editor of book published through the Royal Society of Chemistry’s Energy and Environment Book Series, titled [Ultrathin Oxide Layers for Solar Fuels and Electrocatalytic Systems](#) (co-edited with Heinz Frei at Lawrence Berkeley National Lab). Published in 2023.
- Steering Committee Member for DOE- and German Ministry of Education and Research (BMBF)-sponsored initiative to help coordinate workshops, panel discussions, and webinars on diverse topics relating to renewable fuels production. (2021-2022)
- Participant in 3-day U.S.-German Workshop on “Artificial Photosynthesis” organized jointly by the US DOE (BES) and German Federal Ministry of Education and Research (BMBF). Workshop was attended by  $\approx 30$  top researchers in the US and Germany active in solar fuels research. (Originally scheduled to be in Berlin, Germany but switched to virtual meeting, June 2020)
- Participant in DOE BES roundtable workshop on liquid solar fuels that was tasked with identifying priority research opportunities for the solar fuels field. Contributed 3-page write-up to pre-workshop factual document and contributed written sections to the final workshop report. (Rockville MD, August 2019)
- Reviewed standard operating procedure (SOP) documents associated with best-practice testing procedures for photoelectrochemical cells and low-temperature electrolyzers as a part of the DOE HydroGEN Benchmarking EMN2B Program. (2019)
- Guest editor for special issue on 3D printing in ECS Interface Magazine. (2015-2016)
- **Conference & workshop organization:**
  - Lead organizer of 2022 Wilhelm Symposium in honor of Jingguang Chen at annual AIChE meeting.
  - Co-workshop lead for U.S.-German virtual workshop series events on “Artificial Photosynthesis”: September 2021, May 2022.

- Co-Session lead for the 3<sup>rd</sup> Annual DOE HydroGEN Advanced Water Splitting Technology Pathways Benchmarking and Protocols Workshop. Co-wrote report submitted to DOE based on information collected in this session and follow-up survey. (Virtual, March 1<sup>st</sup>-3<sup>rd</sup>, 2021).
- Lead organizer or Co-organizer for tutorial session on electrochemistry at annual AIChE meeting. (annually between 2014-2019, 2021)
- Lead organizer for new symposium on “Light-Driven Chemistry” at ACS Spring meetings. 2017 symposium featured 6 sessions involving ~65 talks. (2017, 2019)
- Co-organizer and participant in 2-day Gerischer Conference and workshop on Photocatalysis. Boulder, Colorado. (August 2018)
- Co-organizer for Closing the Carbon Cycle Workshop at Columbia U., which included ~ 25 experts from university, industry, and national labs to discuss “Fuel Generation in Remote Locations”. Co-sponsored by the Lenfest Center, Arizona State University, Denmark Technical University (DTU). (October 2017)
- Co-lead organizer for NSF- and ARL-funded workshop on solar fuels production by photovoltaic-electrolysis, hosted by the University of Delaware. Organized sessions, invited speakers, lead break-out sessions. (March 2016)

## **DEPARTMENTAL AND UNIVERSITY SERVICE**

- Departmental ABET representative. Attend monthly ABET meetings, collect course materials from colleagues, co-wrote ABET 2024 report, coordinate departmental small committee meetings. (2023-present)
- Departmental leadership committee. Attend monthly meetings with department chair, vice chair, and other committee chairs to coordinate efforts and discuss pressing matters related to departmental affairs. (2023-present)
- Undergraduate committee. Conducted biannual student advising (20-40 students/semester), curated advising forms, curated senior theses, conducted graduation clearances, organized and participated in various recruitment events, orientation, student lunches, graduation banquets, & resume workshops. (2014-2019 (member), 2023-present (Chair))
- ChemE car club advisor. Meet with and provide guidance to students related to ChemE car club activities. (2023-present)
- DUBY Award Committee Chair. Coordinate with other committee members to solicit nominations and select awardees for the Paul DUBY Award in Electrochemistry. (2022-present)
- Masters committee. Participated in academic advising, program planning meetings, and assisted with the recruiting and admissions process including co-organization of Open Houses. (2020-2022)
- Mentor for Egleston Scholars. Assist in recruiting perspective scholars and participated in “enhanced advising” sessions with current Egleston students assigned as mentees. (2019-present)
- Coordinated Chemical Engineering REU program. (Summer 2019)
- Represented ChemE department at the SEAS Open House for admitted high school seniors. (April 2019)
- Organizer for department seminar series and student colloquium (Spring 2015-2018)
- Served as internal reviewer for SEAS seed funding programs (RISE, SIRS) (8 times)
- Department liaison with the Societe de Chimie Industrielle (2016-2018)
- Scribe for departmental meetings. (Fall 2014-Fall 2016)
- Active participant in faculty candidate recruitment. (every year 2014-2019, 2022-2024)

- Served on Panel: “Preparing for the Academic Search Process Panel”. (2017, 2019, 2020)

## OUTREACH, PUBLIC ENGAGEMENT, AND ENTREPRENEURIAL ACTIVITIES

### ▪ Interviews and press releases:

- Sept. 2023, “[Bringing Down Emissions in Three Carbon-intensive Sectors](#)”, interview with Grant Currin from Columbia Engineering News.
- February 2022, “[Columbia Receives \\$4.8 Million for ‘High Risk, High Reward’ Research](#)”, Strauss news / The Spirit, highlights new DOE project on water electrolysis.
- September 2020, “[Cleaning up the Construction Industry](#)”, highlight on joint research with the Kawashima Lab in the Columbia Engineering Magazine.
- February 2019, Solar Fuels Engineering Lab selected for “[Research Lab Highlight](#)” feature article in newsletter for the International Association of Hydrogen Energy.
- April 2018, “[Chemical Engineer Daniel Esposito Wins NSF CAREER Award](#)”, CU press release.
- Dec. 2017, press releases related to publication in the International J. of Hydrogen Energy: “[Columbia Engineers Develop Floating Solar Fuels Rig for Seawater Electrolysis](#)”, press release written by Holly Evarts in Columbia Engineering. Additional articles or press releases written by Newsweek, [Smithsonian.com](#), ScienceDaily, NBC News, IEEE Spectrum, Materials World..
- Aug. 2016, “[Turning Sunlight into Fuel](#)” interview with Earth Institute blogger.
- Spring 2016, “[From All Corners of Engineering, Sustainable Energy Solutions in the Works](#)”. Article in the Columbia Engineering Magazine,
- Oct. 2014, “[Converting Sunlight into Storable Solar Fuels](#)”, write-up by CU SEAS.

### ▪ Educational or public outreach seminars and panels:

- (Virtual) Guest lecture on solar fuels at Texas A&M University (October 2021).
- Panelist on virtual workshop event hosted by SEAS for summer undergraduate and MS students seeking research opportunities (February, 2021).
- Served on Panel: “Preparing for the Academic Search Process Panel” workshop for SEAS PhD and postdocs interested in pursuing academic careers (Oct. 2017 – Dec. 2020).
- Seminar on finding, reading, and evaluating academic research articles to ~ 12 Bridge-to-PhD Summer@SEAS undergraduate researchers. (Summer 2019, summer 2020, Fall 2020).
- Invited speaker at the Sustainable Westchester Hydrogen Mini-Conference, White Plains, NY, December 2019.
- Served on panel for Columbia Engineering Energy Club event on the future of energy, attended by 50+ students. (Oct. 2019)
- Seminar on Solar Fuels to the Columbia Global Center for Energy Policy (GCEP), September 2018.
- Served on AIChE /Chemist Club career panel event, April 2018.
- Public seminar (“Master Class”) on solar energy as a part of the SEAS Preview Day for prospective undergrad students and their families (~ 200 people), July 2018.
- Public seminar on solar fuels as a part of Columbia Family Weekend, October 2017.
- Seminar to high school students in Columbia’s “Upward Bound” summer program for 1<sup>st</sup> generation college students, July 2017.
- Evening seminar & panel discussion, Columbia Energy Club, April 2017.
- Lunch-time seminar to Columbia summer REU students, July 2016-2018.
- Evening seminar to the Columbia University Undergraduate Energy Club, Nov. 2015.

- **K-12 outreach:** Lead lab tours and demos in coordination with Columbia SEAS outreach office for various programs and local high schools (SEAS Inside Engineering (4-6 times), SEAS SHAPE program, ELLIS school, Mott Hall middle school, CU Society of Hispanic Professional Engineers, GOALS for Girls, and more). (2016-present)
- **High school research:** Mentored 8 URM and/or female high school researchers for summer research through the SEAS Engineering the Next Generation (E.N.G.) Program. All 8 are pursuing or planning to pursue college degrees.
- **Entrepreneurial activities:**
  - Co-founder and advisor of start-up company, sHYp BV PBC, which is developing electrolysis systems for maritime applications. Actively engaged with technology development, techno-economic analysis, pilot plant design, and fundraising. Raised over \$ 3 M to date. (2019-present)
  - Advisor of start-up company, Turnover Labs, which was founded by former student Dr. Marissa Beatty and is developing carbon dioxide electrolyzers for converting impure streams of carbon dioxide into chemicals. (2024-present)
  - Lead PI on a project funded through the NY State Powerbridge Accelerator Program, which sponsors university research projects aimed at translating clean technology into the market place. (2019-2020)
  - Delivered annual lecture on technoeconomic analysis as a part of elective course on solar fuels (CHEN E4330), as well as a colleague's class (EAEE E4305) on CO<sub>2</sub> utilization and conversion (2017-2020).
  - Served as a tutor and organizer as a part of a tutorial session on “setting up an electrochemistry start-up company” at the 2021 International Society of Electrochemistry meeting. (Virtual).