Daniel Esposito

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EDUCATION

Postdoctoral Fellowship 2011-2014
National Institute of Standards and Technology, Gaithersburg, MD
National Research Council (NRC) Fellowship Program
Project Title: "In-situ Evaluation of the Properties and Performance of Metal-Insulator-Semiconductor (MIS) Photoelectrodes with High Spatial Resolution"
Advisors: Dr. Thomas Moffat, Dr. Alec Talin

Ph.D., Chemical Engineering Jan. 2012
University of Delaware, Newark DE
Solar Hydrogen IGERT Program
Dissertation: "Development of Tungsten-based Catalytic Materials for Photoelectrochemical Applications"
Advisors: Dr. Jingguang Chen, Dr. Robert Birkmire

B.S., Chemical Engineering May 2006
Lehigh University, Bethlehem PA
Graduated Tau Beta Pi, and with institutional honors

PROFESSIONAL EXPERIENCE

Assistant Professor 2014-present
Department of Chemical Engineering, Columbia University, New York, NY

Postdoctoral Research (NRC Fellowship) 2012-2014
National Institute of Standards and Technology, Gaithersburg, MD

Thesis Research 2006-2011
University of Delaware, Institute of Energy Conversion, Newark, DE
Advisors: Dr. Jingguang Chen, Dr. Robert Birkmire

Internship 2010
Hawaii Natural Energy Institute, University of Hawaii, Honolulu, HI
Supervisors: Dr. Nicolas Gaillard, Dr. Eric Miller

RESEARCH INTERESTS

- Photoelectrochemical engineering for solar fuels production
  - Photoelectrochemistry (PEC)
  - Photovoltaic (PV)-electrolysis cells
  - Electrolyzers and fuel cells
  - Metal-Insulator-Semiconductor (MIS) photoelectrodes & PV cells
  - Solar reactors
- Electrocatalysis and photocatalysis
  - Catalyst design, synthesis, and characterization
  - Interfacial charge transfer phenomena
  - High-throughput screening of catalytic and photocatalytic materials
  - Electrodeposition of electrocatalytic materials
- Nano- and micro-scale *in-situ* evaluation of PEC, PV, and catalytic materials and devices
  - Laser beam induced current analysis
  - Scanning electrochemical microscopy
  - Spectroelectrochemistry (Raman, SERS)

PUBLICATIONS & PRESENTATIONS

Articles (* denotes shared first-authorship)

1. **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).
2. 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. Brunschwig and N. Lewis. "A Scanning Probe Investigation of the Role of Surface Motifs in the Behavior of p-WSe2 Photocathodes." *Energy & Environmental Science*, (in press, doi: 10.1039/C5EE02530C), (2015).
3. **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).
4. **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). **(Highlighted as a NIST tech beat item, in Clean Technica, and in EARTH Magazine)**
5. **D.V. Esposito*,** R.V Forest*, 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_3-based Tandem Cell Device". *Energy & Environmental Science*, vol. 5, 9091-9099, 2012.
6. **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. **(Highlighted in Chemical & Engineering News)**
7. M. C. Weidman, **D.V. Esposito**, Y.C. Hsu, and J.G. Chen, "Comparison of Electrochemical Stability of Transition Metal Carbides (WC, W_2C, Mo_2C) Over a Wide pH Range". *Journal of Power Sources*, vol. 202, 11-17, 2012.

8. 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.
9. **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. **(Invited Perspective, selected as a high impact review article on electrocatalysis research on EES website)**
10. 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.
11. **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_3 Thin Film Electrodes". *International Journal of Hydrogen Energy*, vol. 36, 9632-9644, 2011.
12. **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. **(Cover article and Angewandte Chemie press release)**
13. 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.
14. 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_2O_3 Nano/Microstructures with Interstitial Nitrogen". *J. Phys. Chem. C*, vol. 114, 13234-13240, 2010.
15. **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.
16. **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.
17. 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_2C) Films". *Journal of Power Sources*, vol. 193, pp. 501-506, 2009.
18. 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.

Patents

1. **D.V. Esposito**, A.A. Talin, and T.P. Moffat, "Photoactive article, process for making, and use of same". US 2014/0318978 A1, (2014). US Patent App. 14/269,411
2. **D.V. Esposito**, Glen D. O'Neil, "Membraneless Electrochemical Flow-Through Reactor". (patent applied for, U.S. 62220707)

Oral Presentations

1. Departmental Seminar, City University of New York (CUNY) Queens, Chemistry Department, December 2015. (**Invited Talk)**
2. AIChE Fall meeting, Salt Lake City, UT, November 2015.
3. ECS Fall Meeting, Phoenix AZ, October 2015. (**Invited talk**)
4. SPIE Optics and Photonics Conference, San Diego CA, August 2015. (**Invited talk**)
5. ECS Spring Meeting, Chicago, IL, May 2015. (**Invited talk**)
6. MRS Spring Meeting, San Francisco, CA, April 2015.
7. ACS Spring Meeting, Denver, CO, March 2015. (**Invited talk**)
8. Departmental Seminar, Rochester Institute of Technology School of Chemistry and Materials Science, Rochester, NY (March 5th 2015) (**Invited Talk)**
9. AIChE annual meeting, Atlanta, GA, (November 17th, 2014)
10. Electrodeposition Gordon Research Conference, Biddeford Maine, (July 29th, 2014) (**Invited Talk)**
11. AIChE meeting, San Francisco, CA, (November 6th, 2013)
12. 224th ECS meeting, San Francisco, CA, (October 29th, 2013) (**Invited Talk)**
13. **Invited Seminar** for the Columbia EFRC Seminar Series, Columbia University, NY, (September 18th, 2013)
14. Interagency meeting on Hydrogen and Fuel Cells (IWG), Washington, D.C., (September 17th, 2013) (**Invited Talk)**
15. SPIE Optics and Photonics Conference, San Diego, CA, (August 25th, 2013). (**Invited Talk)**
16. **Invited Seminar** at the California Institute of Technology, Pasadena, CA (Aug. 23rd, 2013).
17. MRS Spring meeting, San Francisco, CA (April 3rd, 2013).
18. Seminar at Sandia National Laboratories, Livermore, CA (April 1st, 2013). (**Invited Seminar)**
19. Seminar at Brookhaven National Laboratory, Upton, NY (March 8th, 2013). (**Invited Seminar)**
20. AIChE Annual Meeting, Pittsburgh, PA, (October 31st, 2012).
21. SPIE Optics and Photonics conference, San Diego, CA, (August 15th, 2012).
22. Ph.D. thesis defense, University of Delaware, Newark, DE, (August 31st, 2011).
23. ECS Spring Meeting, Montreal, Canada (May 4th, 2011).
24. AIChE Annual Meeting, Salt Lake City, UT, (November 9th, 2010).
25. MRS Fall Meeting, Boston, MA, (December 27th, 2009).
26. AIChE Annual Meeting, Nashville, TN, (November 13th, 2009).
27. IGERT Energy and Sustainability Conference, Newark, DE, (August 11th, 2009).
28. AIChE Annual Meeting, Philadelphia, PA, (November 20th, 2008).

TEACHING AND MENTORING EXPERIENCE

Course Instructor, CHEN E4330 "Advanced Chemical Kinetics", Columbia University 2014-2015

- Taught a 70-student graduate class covering reaction kinetics, reactor design, and special kinetics topics such as photocatalysis and electrochemical reactions.

Course Instructor, CHEN E4231 "Solar Fuels", Columbia University Spring 2016

- Taught a 35-student elective course covering fundamentals and applications of technology for converting solar energy into fuels.
- Includes open ended project built on problem based learning methodology

Mentor for undergraduate research, University of Delaware, NIST 2008 – 2013

- Served as the primary mentor for six undergraduate students, teaching them various laboratory techniques, data analysis methods, and critical thinking skills while providing direction and guidance on their research projects.
- Co-published six different journal articles with four of these students.
- Three of my mentees have received NSF graduate fellowships, and one of my mentees received a Barry M. Goldwater Award for excellence in academics and research.

TEACHING INTERESTS

- Kinetics and reactor design
- Mass and energy balance
- Transport phenomena (Fluid mechanics, Heat, Mass)
- Electrochemistry (electrocatalysis, corrosion chemistry, fuel cells)
- Matlab-based engineering coursework, numerical methods
- Photovoltaics and solar fuel technologies
- General energy and sustainability coursework

AWARDS

- NRC Postdoctoral Fellowship, National Institute of Standards and Technology National Research Council Postdoctoral Research Associateship Program-2011
- Graduate Fellowship, University of Delaware, Bill N. Baron Fellowship Award-2010
- Graduate Fellowship, University of Delaware, NASA Delaware Space Grant College and Fellowship Program-2008
- Graduate Fellowship, University of Delaware, Solar Hydrogen IGERT Program-2006
- American Chemical Society Award for outstanding senior in Chemical Engineering at Lehigh University-2006
- Lehigh University, Chandler Award for excellence in Chemical Engineering – 2004

SERVICE AND PROFESSIONAL ACTIVITIES

- Co-organizer for Workshop on Photovoltaic Electrolysis (Newark, DE) March 2016
- Organizer for Chemical Engineering seminar series 2015-2016
- Served on Chemical Engineering Department Undergraduate Committee 2014-2016
- Lead organizer of ACS George Olah Award Symposium (Denver, CO) March 2015
- Co-organizer for session on electrochemistry at annual AIChE meeting. (Atlanta, GA) 2014-present
- Served as a reviewer for the following funding agencies: DOE/EERE, NSF. 2013-2015
- Actively involved with the DOE working group on photoelectrochemistry, attending biannual meetings, and organizing/participating in collaborative white papers. 2013-present
- Organizer and volunteer for student-run IGERT Energy & Sustainability Annual Conference. 2007-2010

PROFESSIONAL AFFILIATIONS

American Institute of Chemical Engineers, Electrochemical Society, Tau Beta Pi Engineering Honor Society