

## Kevin N. Wood

Materials Science/Mechanical Engineering  
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### EDUCATION

Colorado School of Mines, Golden, Colorado

- **Ph.D.** in Material Science, 2014
  - Area of Specialization: Electrochemistry/Surface Chemistry
  - Cumulative GPA: 3.95/4.00
- **M.E.** in Materials Engineering, 2012
  - Cumulative GPA: 4.00/4.00
- **B.S.** in Physics, 2010
  - Cumulative GPA: 3.56/4.00

### AWARDS/HONORS

- 2017 NREL Key Contributor
- Rackham Postdoctoral Fellow 2014-2016
- 2016 Beyond Li-Ion Battery IX Best Poster Award
- National Science Foundation Joint US-Africa Materials Initiative Fellow 2012
- National Science Foundation Graduate Fellowship, 2010-2011
- NCAA DII Outstanding Academics Award 2009-2010
- Graduated Cum Laude in B.S. of Physics 2010

### EXPERIENCE

**Assistant Professor:** Mechanical Engineering, *San Diego State University*, 2018-Present

**Postdoctoral Researcher:** Chemical and Materials Science, *National Renewable Energy Laboratory*, 2017-present

- Part of National Laboratory consortium on Si anode battery development
- Developed operando XPS/SIMS technique for Li and solid electrolyte battery materials
- Additional projects and publications include: Biomass Conversion, III-V PV Materials, and Hydrogen Storage

**Adjunct Professor:** Metallurgical and Materials Engineering, *Colorado School of Mines*, 2017-2018

- Developing and teaching graduate level course on Battery Science and Technology
- Topics Covered: Thermodynamics, Kinetics, Mass Transport, Anodes, Cathodes, Electrolytes, SEI, Thermal Challenges, and Device Implementation

**Research Fellow:** Department of Mechanical Engineering, *University of Michigan*, 2014-2016 (advisor: Dr. Neil Dasgupta)

- Member of Joint Center for Energy Storage Research (JCESR)
- Member of Advanced Research Projects Agency (ARPA-E) team for solid electrolyte batteries
- Developed fundamental understand of dendritic phenomena for Li metal anodes
- Improved Li-metal battery performance through ALD coatings and treatment procedures.
- Assisted in grant writing, new laboratory setup, purchasing equipment, and designing new battery testing techniques
- Additional projects and publications included: semiconductor synthesis, photoelectrochemistry, biomimicry, and composite mechanics

**Doctoral Research:** Department of Metallurgical and Material Science, *Colorado School of Mines*,

2010-2014, (advisor: Dr. Ryan P. O'Hayre)

- Development of fuel cell catalysts for PEM, DAFC and DMFC by improving catalyst-support interactions
- Functionalization of the carbon-based materials using ion-implantation for energy storage systems
- Focus on modifying support structure with nitrogen and halide functionalization

**Undergraduate Research:** Department of Physics, *Colorado School of Mines*, 2009-2011 (advisor: Dr. Rueben Collins)

- Research in superhydrophobicity and photosensitive smart surfaces for optically switchable wetting
- Biomimetic devices used in medical applications

## **SKILLS**

Electrochemical Characterization, CV, EIS, TEM, SEM, FTIR, Raman, SAXS, NEXAFS, XPS, AES, SIMS, EDS, XRD, TGA, ALD, FIB, EBSD, RBS, Sputter/Evap Deposition, Glovebox, Teaching, Materials, Batteries, Fuel Cells, Metallurgy, Mathematica, LaTeX, CAD, Igor, Illustrator, Photoshop, Photography

## **RESEARCH INTERESTS**

Energy Conversion, Batteries, Interfacial Engineering, Heterogeneous Catalysis, Fuel cells, Supercapacitors, Electrochemical Characterization, X-ray Characterization, Organic Photovoltaics, Biomimetic Materials.

## **TEACHING EXPERIENCE**

**Adjunct Professor:** Colorado School of Mines, 2017-2018

**Invited Lecturer:** Colorado School of Mines & University of Michigan, 2013-2017.

- Lectured in classes on electrochemistry, batteries, fuel cells, energy, materials, and mechanics

**Instructor/Caretaker:** Confocal Raman, Colorado School of Mines, 2010-2014.

- Trained students/faculty on Raman characterization. Support assistance on other projects

**Teaching Assistant:** Graduate Solid-State Physics, Colorado School of Mines, 2012.

- Homework assistance and grading

**Instructor:** 8th Grade Physics Teacher, East Middle School, Aurora, 2010-2011.

- Contributions led to the advancement in the learning of science, technology, engineering and mathematics (STEM) in the minds of 8th grade students

## **UNIVERSITY SERVICES**

- **Member:** Materials Research Society (MRS) 2016-present
- **Member:** Electrochemical Society (ECS) 2016-present
- **Student Member:** Electrochemical Society (ECS), 2010-2014
- **Student Member:** American Chemical Society (ACS), 2010-2014
- **Student Organizer:** Fellowship of Christian Athletes, 2008-2014.
- **Captain and Athlete:** Varsity Men's Swim Team, Colorado School of Mines, 2007-2010.

## **PROVISIONAL PATENTS**

1. **K.N. Wood**, E. Kazyak, K.H. Chen, N.P. Dasgupta, Method of Improved Performance in Lithium Metal Electrodes, Provisional Filed 2017/ Full Filed 2018
2. N Dasgupta, L Thompson, **K.N. Wood**, Metal Nitride Modified Carbon Supports for Low Temperature Fuel Cells, 2015, 62/164,758

## **JOURNAL PUBLICATIONS**

1. **K.N. Wood**, Steirer, K. X., Hafner, S. E., Ban, C., Santhanagopalan, S., Lee, S.-H., & Teeter, G. Operando

- X-ray photoelectron spectroscopy of solid electrolyte interphase formation and evolution in Li<sub>2</sub>S-P2S<sub>5</sub> solid-state electrolytes. *Nature Communications*, 9(1), 2490, 2018
2. Y. Xu, C. Stetson, **K.N. Wood**, C.S. Jiang, G. Teeter, S. Pylypenko, S.D. Han, A. Burrell, A. Zakutayev “Mechanical Properties and Chemical Reactivity of Li<sub>x</sub>SiO<sub>y</sub> Thin Films” *ACS Applied Materials & Interfaces*, 10(44), 38558–38564.
  3. **K.N. Wood**, & Teeter, G. (2018). XPS on Li Battery Related Compounds: Analysis of Inorganic SEI Phases and a Methodology for Charge Correction. *ACS Applied Energy Materials*, 1(9), 4493–4504
  4. **K.N. Wood**, K.H. Chen, E.F. Kazyak, W.S. LePage, A.L. Davis, A.J. Sanchez, N.P. Dasgupta “*In-situ* Treatment Procedures for High Performance Li Metal Anodes” In Progress, 2018
  5. E. Arca, A. Fioretti, S. Lany, A. Tamboli, G. Teeter, C. Melamed, J. Pan, **K.N. Wood**, E. Toberer, A. Zakutayev “Band Edge Positions and Their Impact on the Simulated Performance of ZnSnN<sub>2</sub> Solar Cells” *IEEE J. Photovoltaics* 2018, 8 (1), 110–117.
  6. D. Vardon, A.E. Settle, V. Vortnikov, M.J. Menart, T.R. Eaton, K.A. Unocic, K.X. Steirer, **K.N. Wood**, N.S. Cleveland, K.E. Moyer, W.E. Michener, and G.T. Beckham “Ru-Sn/AC for Aqueous Phase Reduction of Succinic Acid to 1,4-Butanediol under Continuous Process Conditions” *ACS Catal.* 2017, 6207–6219
  7. E. Kazyak, **K.N. Wood**, K.H. Chen, A.L. Davis, A.R. Bielinski, T. Thompson, J. Sakamoto, N.P. Dasgupta “Atomic Layer Deposition of the Solid Electrolyte Garnet Li<sub>7</sub>La<sub>3</sub>Zr<sub>2</sub>O<sub>12</sub>” *Chem. Mater.* 2017, 29 (8), 3785–3792.
  8. **K.N. Wood**, M. Noked, N.P. Dasgupta “Towards an Improved Understanding of the Morphological, Electrochemical, and Mechanical Behavior of Lithium Metal Anodes” *ACS Energy Lett.* 2017, 2 (3), 664–672.
  9. K.H. Chen, **K.N. Wood**, E.F. Kazyak, W.S. LePage, A.L. Davis, A.J. Sanchez, N.P. Dasgupta “Dead Lithium: Mass Transport Effects on Voltage, Capacity, and Failure of Lithium Metal Anodes” *J. Mater. Chem. A* 2017, 5 (23), 11671–11681.
  10. **K.N. Wood**, E. Kazyak, A.F. Chadwick, K.H. Chen, J.G. Zhang, K. Thornton and N.P. Dasgupta “Dendrites and Pits: Untangling the Complex Behavior of Lithium Metal Anodes Through Operando Video Microscopy” *ACS Cent. Sci.*, 2016, 2, 790–801
  11. **K.N. Wood**, S.T. Christensen, D. Nordlund, A.A. Dameron, C. Ngo, H. Dinh, T. Gennett, R. O’Hayre and S. Pylypenko “Spectroscopic Investigation of Nitrogen Functionalized Carbon Materials” *Surf. Interface Anal.* 2016, 48, 283
  12. **K.N. Wood**, E. Kazyak, and N.P. Dasgupta “Improved Cycle Life and Stability of Lithium Metal Anodes through Atomic Layer Deposition Surface Treatments” *Chem. Mater.* 2015, 27, 6457.
  13. A.R. Bielinski, E. Kazyak, C.M. Schlepütz, H.J. Jung, **K.N. Wood** and N.P. Dasgupta “Hierarchical Growth of ZnO Nanowires Controlled by Atomic Layer Deposition Surface Modification” *Chem. Mater.* 2015, 27, 4799.
  14. **K.N. Wood**, S. Pylypenko, A.A. Dameron, P. Joghee and R. O’Hayre. “Nitrogen Post Modification for Improved Methanol Oxidation” *J. Electrochem. Soc.*, 2015, 162, F913-F918
  15. P. Joghee, S. Pylypenko, **K.N. Wood**, G. Bender, and R. O’Hayre, “High performance alkaline direct methanol fuel cell employing a nitrogen post-doped PtRu/C anode” *Chem Comm.* DOI: 10.1002/cssc.201400158
  16. **K.N. Wood**, S. Pylypenko, and R. O’Hayre, “Recent Progress on Nitrogen/Carbon Structures Designed for use in Energy and Sustainability Applications” *Energy. Environ. Sci.*, 2014, 7, 1212-1249
  17. A.R. Corpuz, **K.N. Wood**, S. Pylypenko, A. A. Dameron, P. Joghee, T. S. Olson, G. Bender, H.N. Dinh, T. Gennett, and R. M. Richards, “Effect of nitrogen post-doping on a commercial platinum–ruthenium/carbon anode catalyst” *J. Power Sources*, 2014, 248, 296–306.
  18. P. Joghee, S. Pylypenko, **K.N. Wood**, A. Corpuz, G. Bender, H. N. Dinh, and R. O’Hayre, “Improvement in direct methanol fuel cell performance by treating the anode at high anodic potential” *J. Power Sources*, 2014, 245, 37–47.
  19. T.S. Olson, A. A. Dameron, **K.N. Wood**, S. Pylypenko, K. E. Hurst, S. Christensen, J. B. Bult, D. S. Ginley, R. O’Hayre, and H. Dinh, “Enhanced Fuel Cell Catalyst Durability with Nitrogen Modified Carbon Supports” *J. Electrochem. Soc.*, 2013, 160, F389–F394.
  20. P. Joghee, S. Pylypenko, T. Olson, A. Dameron, A. Corpuz, H. N. Dinh, **K.N. Wood**, K. O’Neill, K. Hurst, and G. Bender, “Enhanced Stability of PtRu Supported on N-Doped Carbon for the Anode of a

- DMFC” *J. Electrochem. Soc.*, 2012, 159, F768–F778.
21. **K.N. Wood**, S. Pylypenko, T. S. Olson, A. A. Dameron, K. O’Neill, S. T. Christensen, H. N. Dinh, T. Gennett, and R. O’Hayre, “Effect of halide-modified model carbon supports on catalyst stability” *ACS Appl. Mater. Interfaces*, 2012, 4, 6728–6734.
  22. **K.N. Wood**, S. T. Christensen, S. Pylypenko, T. S. Olson, A. A. Dameron, K. E. Hurst, H. N. Dinh, T. Gennett, and R. O’Hayre, “In situ small-angle x-ray scattering analysis of improved catalyst—support interactions through nitrogen modification” *MRS Commun.*, 2012, 2, 85–89.

## **CONFERENCE PROCEEDINGS**

1. G. Teeter and **K.N. Wood**, “Operando XPS and Application for Battery Materials” AIP Horizons Cambridge, 2018
2. **K.N. Wood**, and G. Teeter, “Electrochemical AES Mapping and operando XPS Measurements of SEI Formation and Evolution in Li 2 SP 2 S 5 Solid-State Electrolytes” Fall MRS 2017
3. **K.N. Wood**, E. Kazyak, K.H. Chen, N.P. Dasgupta, “Dendrites and Pits: Untangling the Complex Behavior of Lithium Metal Anodes Through Operando Video Microscopy” Spring ECS 201
4. K.H. Chen, **K.N. Wood**, E.F. Kazyak, W.S. LePage, A.L. Davis, A.J. Sanchez, N.P. Dasgupta, “The Impact of Dead Li on Mass Transport, Voltage Profiles, Capacity, and Failure of Lithium Metal Anodes” Spring ECS 2017
5. **K.N. Wood**, E. Kazyak, K.H. Chen, N.P. Dasgupta, “Dendrites and Pits: Untangling the Complex Behavior of Lithium Metal Anodes Through Operando Video Microscopy” Spring ECS 2017
6. **K.N. Wood**, E. Kazyak, K.H. Chen, N.P. Dasgupta, “Dendrites and Pits: Untangling the Complex Behavior of Lithium Metal Anodes Through Operando Video Microscopy” Fall MRS 2016
7. **K.N. Wood**, E. Kazyak, K.H. Chen, N.P. Dasgupta, “Operando Visual and Electrochemical Correlation of Dendrite Evolution in Li Metal Electrodes” Inter. Meet. Li Bat. 2016
8. **K.N. Wood**, E. Kazyak, N.P. Dasgupta, “Improved Li Metal Anode Stability Through ALD Surface Modifications” Beyond Lithium Ion Battery Conference VIII, 2015
9. **K.N. Wood**, S. Pylypenko, A. Corpuz, P. Joghee, A. Dameron, H. N. Dinh, T. Gennett, and R. O’Hayre, “Performance of Nitrogen-Modified Commercial Catalysts in Acid and Alkaline Media” Meet. Abstr., 2013, 1576.
10. S. Pylypenko, **K.N. Wood**, A. Serov, P. Atanassov, and R. O’Hayre, “N-Doped Graphene-Supported PtRu Direct Methanol Fuel Cell Electrocatalysts” Meet. Abstr., 2013, 1603.
11. S. Pylypenko, A. Corpuz, T. Olson, A. Dameron, **K. N. Wood**, P. Joghee, K. Hurst, S. Christensen, D. Ginley, and B. S. Pivovar, “Effect of N-doping on Performance and Durability of Supported PtRu Direct Methanol Fuel Cell Catalyst” Meet. Abstr., 2012, 1340.
12. S. Pylypenko, **K.N. Wood**, T. S. Olson, A. Dameron, K. O’Neill, B. Pivovar, H. N. Dinh, T. Gennett, and R. N. O’Hayre, “Improving catalyst-support interactions: From model systems to high-performing direct methanol fuel cell catalysts” Abstract of Paper of the American Chemical Society, 2011, vol. 242.
13. **K.N. Wood**, S. Pylypenko, T. S. Olson, A. Dameron, K. O’Neill, B. Pivovar, H. N. Dinh, T. Gennett, and R. N. O’Hayre, “Modifying fuel cell catalyst supports through fluorine, iodine, and nitrogen functionalization” in Abstract of the American Chemical Society, 2011, vol. 242.
14. S. Pylypenko, T. Olson, A. Dameron, A. Borisevich, K. More, T. Holme, **K.N. Wood**, K. O’Neill, K. Hurst, and S. Christensen, “Tuning of Surface Composition and Structure of N-functionalized Carbon Supports and Pt-Ru Phase for Direct Methanol Fuel Cell Applications” Meet. Abstr., 2011, 1191.
15. **K.N. Wood**, S. Pylypenko, T. Olson, A. Dameron, K. O’Neill, C. C. Hays, M. A. Johnson, B. Pivovar, H. Dinh, and T. Gennett, “Functionalization of Fuel Cell Catalyst Supports with Nitrogen, Fluorine and Iodine” Meet. Abstr., 2011, 1217.
16. **K.N. Wood** and B. Moskal. “Renewable Energy: Teaching for the Future” Annual National GK-12 Meeting Abstracts 2011.
17. Glushchenko, **K.N. Wood**, A. Rockwood, J. West, G. Zhang, and K. Zhang, “Stressed liquid crystals for fast phase retardation switching” *Am. Phys. Soc.*, 2007.