Raymond R. Unocic

R&D Staff Scientist
Electron Microscopy and Atom Probe Tomography Group
Center for Nanophase Materials Sciences
Oak Ridge National Laboratory

Education:

The Ohio State University, Columbus, OH	Materials Science and Engineering	Ph.D. (2008)
Lehigh University, Bethlehem, PA	Materials Science and Engineering	M.S. (2003)
The Ohio State University, Columbus, OH	Metallurgical Engineering	B.S. (2000)

Research and Professional Experience:

2013-*Present*	R&D Staff Scientist	Oak Ridge National Laboratory
2011-2013	R&D Associate	Oak Ridge National Laboratory
2009-2011	Alvin M. Weinberg Fellow	Oak Ridge National Laboratory
2008-2009	Postdoctoral Researcher	The Ohio State University

Honors and Awards:

2015 R&D 100 Award: Porous Graphene Desalination Membrane
2015 ORNL/UT Battelle Research Team Award: Porous Graphene Desalination Membrane
2015 Significant Event Award: Graphene Desalination Membrane, ORNL
2015 Significant Event Award: Development of Scanning Electron Nanopositioning System, ORNL
2013 Significant Event Award: Na-Ion Battery Research, ORNL
2013 Best Presentation at the 3rd Hitachi Advanced Microscopy Workshop
2012 MicroAnalysis Society Birks Award for Best Paper at the Microscopy and Microanalysis Meeting
2009 Alvin M. Weinberg Early Career Fellowship, Oak Ridge National Laboratory
2009 1st Place Transmission Electron Microscopy Class, International Metallographic Contest
2004 Best in Show, Jacque-Lucas Award, International Metallographic Contest
2001 New Jersey Zinc Graduate Fellowship in Metallurgy, Lehigh University
2000 National Collegiate Inventors Competition: Ceramic Matrix Composite Processing

U.S. Patent:

2003 Sandhage KH, Unocic RR, Dickerson MB, Guerra KT, Timberlake MJ, "Method for Fabricating High-Melting, Wear-Resistant Ceramics and Ceramic Composites at Low Temperatures," U.S. Patent No. 6598656.

Book Chapters:

1. Unocic RR, More KL, "Application of Electrochemical Liquid Cells for Electrical Energy Storage and Conversion Studies," in Liquid Cell Microscopy, Cambridge University Press. Eds. Frances Ross and Niels de Jonge, (2016).
2. Sandhage KH, Allan SM, Dickerson MB, Ernst EM, Gaddis CS, Shian S, Weatherspoon MR, Ahmad G, Cai Y, Haluska MS, Snyder RL, Unocic RR, Zalar FM, "Inorganic Preforms of Biological Origin: Shape-Preserving Reactive Conversion of Biosilica Microshells (Diatoms)," Handbook of Biomineralization, Eds E. Bauerlein, P. Behrens, Vol. 2 (Wiley-VCH, Weinheim, Germany) pp. 235-253, 20, (2007).

Journal Articles Published in Peer Reviewed Journals:

65. Kercher AK, Kolopus JA, Carroll KJ, Unocic RR, Kirklin S, Wolverton C, Stooksbury SL, Boatner LA, Dudney NJ, "Mixed Polyanion Glass Cathodes: Glass-State Conversion Reactions," Journal of the Electrochemistry Society, (2016).
64. St John S, Atkinson RW, Roy A, Unocic RR, Papandrew AB, Zawodzinski TA, "The Effect of Carbonate and pH on Hydrogen Oxidation and Oxygen Reduction on Pt-Based Electrocatalysts in Alkaline

Media," Journal of the Electrochemical Society, 163(3), F291-F295, (2016).

63. Ievlev AV, Jesse S, Cochell TJ, Unocic RR, Protopopescu V, Kalinin SV, "A Quantitative Description of Crystal Nucleation and Growth from In situ Liquid Scanning Transmission Electron Microscopy," ACS Nano, 9(12), 11784-11791, (2015).
62. Unocic RR, Baggetto L, Veith GM, Aguiar JA, Unocic KA, Sacci RL, Dudney NJ, More KL, "Probing Battery Chemistry with Liquid Cell Electron Energy Loss Spectroscopy," Chemical Communications, 51, 16377-16380, (2015).
61. Stehle YY, Meyer HM, Unocic RR, Kidder M, Polyzos G, Datkos P, Jackson RK, Smirnov S, Vlassiouk IV, "Synthesis of Hexagonal Boron Nitride Monolayer: Control of Nucleation and Crystal Morphology," Chemistry of Materials, 27, 8041-8047,(2015).
60. St John S, Atkinson RW, Unocic KA, Unocic RR, Zawodzinski TA, Papandrew AP, "Platinum and Palladium Overlayers Dramatically Enhance the Activity of Ruthenium Nanotubes for Alkaline Hydrogen Oxidation," ACS Catalysis, 5(11), 7015-7023, (2015).
59. Jesse S, He Q, Lupini AR, Leonard DN, Oxley MP, Ovchinnikov O, Unocic RR Tselev A, Fuentes-Cabrera M, Sumpter BG, Pennycook SJ, Kalinin SV, Borisevich AY, "Atomic-level sculpting of crystalline oxides: towards bulk nanofabrication with single atomic plane precision," Small, 11(44), 5895-5900, (2015).
58. Binder AJ, Toops TJ, Unocic RR, Parks JE, Dai S, "Low Temperature CO Oxidation over a Ternary Oxide Catalyst with High Resistance to Hydrocarbon Inhibition," Angewandte Chemie, 127(45), 13461-13465, (2015).
57. Atkinson RW. St. John S, Dyck O, Unocic KA, Unocic RR, Burke CS, Cisco JW, Rice CA, Zawodzinski TA, Papandrew AB, "Supportless, Bismuth-Modified Palladium Nanotubes with Improved Activity and Stability for Formic Acid Oxidation," ACS Catalysis, 5, 5154-5163, (2015).
56. Surwade, SP, Smirnov SN, Vlassiouk IV, Unocic RR, Veith GM, Dai S, Mahurin SM, "Water desalination using nanoporous single layer graphene," Nature Nanotechnology, 10, 459-464, (2015).
55. Achtyl JL, Unocic RR, Xu L, Cai Y, Raju M, Zhang W, Sacci RL, Vlassiouk IV, Fulvio PF, Ganesh P, Wesolowski DJ, Dai S, van Duin ACT, Neurock M, Geiger FM, "Aqueous Proton Transfer across single layer graphene," Nature Communications, 6, 6539, (2015).
54. St. John, S, Atkinson RW, Unocic RR, Zawodzinski TA, Papandrew AB, "Ruthenium-Alloy Electrocatalysts with Tunable Hydrogen Oxidation Kinetics in Alkaline Electrolyte," Journal of Physical Chemistry C, 119(24), 13481-13487, (2015).
53. Atkinson, RW, Unocic RR, Unocic KA, Veith GM, Zawodzinski TA, Papandrew AB, "Vapor synthesis and Thermal Modification of Supportless Platinum-Ruthenium Nanotubes and Applications as Methanol Electrooxidation Catalysts," ACS Applied Materials & Interfaces, 7(19), 10115-10124, (2015).
52. Sacci RL, Black JM, Balke N, Dudney NJ, More KL, Unocic RR, "Nanoscale Imaging of Fundamental Li Battery Chemistry: Solid-electrolyte Interphase Formation and Preferential Growth of Lithium Metal Nanoclusters," Nano Letters, 15(3), 2011-2018, (2015).
51. Naguib M, Unocic RR, Armstrong BL, Nanda J," Large-scale delamination of multi-layers transition metal carbides and carbonitrides "MXenes," Dalton Transactions, 44, 9353-9358.
50. Papandrew AB, Atkinson RW, Unocic RR, Zawodzinski TA, "Ruthenium as a CO-tolerant hydrogen oxidation catalyst for solid acid fuel cells," Journal of Materials Chemistry A, 3, 3984-3987, (2015).
49. Hayes RW, Unocic RR, Nasrollahzadeh M, "Creep Deformation of AllVac 718Plus," Metallurgical and Materials Transactions A, 46A(1), 218-228, (2015).
48. Unocic RR, Sun X-G, Sacci RL, Adamczyk LA, Alsem DH, Dai S, Dudney NJ, More KL, "Direct Visualization of Solid Electrolyte Interphase Formation in Lithium-Ion Batteries with In situ Electrochemical Transmission Electron Microscopy," Microscopy and Microanalysis, 20, 1029-1037, (2014).
47. Schultz BM, Unocic RR, DesJardins JD, Kennedy MS, "Formation of a Metallic Amorphous Layer During the Sliding Wear of Ti/TiN Nanolaminates," Tribology Letters, 55, 219-226, (2014).
46. Zhou H Martha SK, Unocic RR, Meyer HM, Nanda J, Sahoo Y, Miskiewicz P, Albrecht TF, "Role of Surface Functionality on the Electrochemical Performance of Silicon Nanowire Anodes for Rechargeable Lithium Batteries," ACS Applied Materials & Interfaces, 6(10), (2014), 7607-7614.

45. Xiao, X, Liu, Z, Baggetto, L, Veith, GM, More, KL, Unocic RR, "Unraveling Manganese Dissolution/Deposition Mechanisms on the Negative Electrode in Lithium Ion Batteries." Physical Chemistry Chemical Physics, 16, (2014), 10398-10402.
44. Baggetto L, Carroll KJ, Hah H-Y, Johnson CE, Mullins DR, Unocic RR, Johnson JA, Meng YS, Veith GM, "Probing the Mechanisms of Sodium Ion Insertion into Copper Antimony Cu_2Sb Anodes," Journal of Physical Chemistry C, 118(15), (2014), 7856-7864.
43. Mehdi BL, Gu M, Parent LR, Xu W, Nasybulin EN, Chen X, Unocic RR, Xu P, Welch DA, Abellan P, Zhang JG, Liu J, Wang CM, Arslan I, Evans J, Browning ND, "*In Situ* Electrochemical Transmission Electron Microscopy for Battery Research," Microscopy and Microanalysis, 20, (2014), 484-492.
42. Sun XG, Liao C, Baggetto L, Guo B, Unocic RR, Veith GM, Dai S, "Bis(fluoromalonato)borate (BFMB) Anion Based Ionic Liquid As an Additive for Lithium-ion Batteries," Journal of Materials Chemistry A, 2, (2014), 7606-7614.
41. Baggetto L, Carroll KJ, Unocic RR, Bridges CA, Meng YS, Veith GM, "Sodium Manganese Oxide Thin Films as Cathodes for Na-Ion Batteries," Electrochemical Society Transactions, 58(12), 47-57, (2014).
40. Veith, GM, Baggetto, L, Sacci RL, Unocic RR, Tenhaeff WE, Browning JF, "Direct Measurement of the Chemical Reactivity of Silicon Electrodes with $LIPF_6$-based Battery Electrolytes," ChemComm, 50(23), (2014), 3081-3084.
39. Unocic RR, Sacci RL, Brown GM, Veith GM, Dudney, More KL, Walden FS, Gardiner DS, Damiano D, Nackashi DP, "Quantitative Electrochemical Measurements using *In Situ* ec-S/TEM Devices," Microscopy and Microanalysis, 20, (2014), 452-461.
38. Sacci RL, Dudney NJ, More KL, Parent LR, Arslan I, Browning ND, Unocic RR, "Direct Visualization of Initial SEI Morphology and Growth Kinetics During Lithium Deposition by in situ Electrochemical Transmission Electron Microscopy," Chemical Communications, 50, (2014). 2104-2107.
37. Bi Z, Paranthaman MP, Guo B, Unocic RR, Meyer HM III, Bridges CA, Sun XG, Dai S, "High Performance Cr, N Co-doped TiO_2 Mesoporous Microspheres for Li-ion Rechargeable Batteries with Enhanced Electrochemical Performance," Journal of Materials Chemistry A, 2(6), (2014), 1818-1824.
36. Arruda TM, Lawton JS, Kumar A, Unocic RR, Kravchenko II, Zawodzinski TA, Jesse S, Kalinin SV, Balke N, "In situ Formation of Micron-scale Li-metal Anodes with High Cyclability," ECS Electrochemistry Letters, 3(1), (2014), A4-A7.
35. Gu M, Parent LR, Mehdi L, Unocic RR, McDowell MT, Sacci RL, Xu W, Connel JG, Xu P, Abellan P, Chen X, Zhang Y, Perea DE, Lauhon LJ, Arslan I, Zhang JG, Liu J, Cui Y, Browning ND, Wang CM, " Demonstration of an Electrochemical Liquid Cell for Operando Transmission Electron Microscopy Observation of the Lithiation/Delithiation Behavior of Si Nanowire Battery Anodes," Nano Letters, 13(12), (2013), 6106-6112.
34. Baggetto L, Allcorn E, Unocic RR, Manthiram A, Veith GM, "Extremely fast reaction kinetics of amorphous Mo_3Sb_7 thin films as anodes for Li- and Na-ion batteries," Journal of Materials Chemistry A, 1(37), (2013), 11163 - 11169.
33. Bridges CA, Harrison K, Unocic RR, Idrobo JC, Paranthaman MP, Manthiram A, "Defects in Microwave Solvothermally Grown Phospho-Olivine Nanoparticles," Journal of Solid State Chemistry, 205, (2013), 197-204.
32. Browning KL, Baggetto L, Delnick FM, Unocic RR, Dudney NJ, Veith GM, "Gas evolution from $LiCoO_2$ cathode materials: A pathway to electrolyte decomposition concomitant to SEI formation." Journal of Power Sources, 239, (2013), 341-346.
31. Yoon S, Bridges CA, Unocic RR, Paranthaman MP, "Mesoporous TiO_2 Spheres with a Nitridated Conducting Layer for Lithium-ion Batteries," Journal of Materials Science, 48, (2013), 5125-5131.
30. Martha SK, Nanda J, Kim Y, Unocic RR, Pannala S, Dudney NJ, "Solid Electrolyte Coated High Voltage Layered-Layered Lithium-rich Composite Cathode: $Li_{1.2}Mn_{0.5}25Ni_{0.175}Co_{0.1}O_2$," *Journal of Materials Chemistry A*, 1, (2013), 5587-5595.
29. Baggetto L, Meisner RP, Ganesh P, Unocic RR, Bridges CA, Jumas J-C, Veith GM, "Characterization of Sodium Ion Electrochemical Reactions with Tin Anodes," Journal of Power Sources, 234, (2013), 48-59.
28. Phillips PJ, Unocic RR, Mills MJ, "Low cycle fatigue of a polycrystalline Ni-based superalloy: Deformation substructure analysis," International Journal of Fatigue, 57, (2013), 50-57.

27. Li HQ, Martha SK, Unocic RR, Luo HM, Dai S, Qu J, "High cyclability of ionic liquid-produced TiO_2 nanotube arrays as an anode material for lithium-ion batteries," Journal of Power Sources, 218, (2012), 88-92.
26. Baggetto L, Unocic RR, Dudney NJ, Veith GM, "Fabrication and characterization of Li-Mn-Ni-O sputtered thin film high voltage cathodes for Li-ion batteries," Journal of Power Sources, 211, (2012), 108-118.
25. Qiao, Z-A, Brown SS, Adcock J, Veith GM, Bauer JC, Payzant A, Unocic RR, Dai S, "A Topotactic Synthetic Methodology for Highly Fluorine-Doped Mesoporous Metal Oxides," Angewandte Chemie, 51(12), 2888-2893, (2012).
24. Chan-Thaw CE, Villa A, Veith GM, Kailasam K, Adamczyk LA, Unocic RR, Prati L, Thomas A, "Influence of Periodic Nitrogen Functionality on the Selective Oxidation of Alcohols," Chemistry-An Asian Journal, 7(2), 387-393, (2012).
23. Yoon, S., Liao, C., Sun, X-G., Bridges CA, Unocic RR, Nanda J, Dai S, Paranthaman MP, "Conductive surface modification of $LiFePO_4$ with nitrogen-doped carbon layers for lithium-ion batteries," Journal of Materials Chemistry, 22, 4611-4614 (2012).
22. Unocic RR, Zhou N, Kovarik L, Shen C, Wang Y, Mills MJ, "Dislocation Decorrelation and Relationship to Deformation Microtwins During Creep of a g′ Precipitate Strengthened Ni-Base Superalloy," *Acta Materialia*, 59, (2011), 7325-7339.
21. Kim Y, Veith GM, Nanda J, Unocic RR, Chi M, Dudney NJ, "High Voltage Stability of $LiCoO_2$, Particles with a Nano-scale Lipon Coating," *Electrochimica Acta*, 56, (2011), 6573–6580.
20. Liu H, Bi Z, Sun X, Unocic RR, Paranthaman MP, Dai S, Brown GM, "Mesoporous TiO_2–B Microspheres with Superior Rate Performance for Lithium Ion Batteries," *Advanced Materials*, 23, (2011), 3450-3454.
18. Liu R, Mahurin SM, Li C, Unocic RR, Idrobo JC, Gao H, Pennycook SJ, Dai S, "Dopamine as a Carbon Source: The Controlled Synthesis of Hollow Carbon Spheres and Yolk-Structured Carbon Nanocomposites," *Angewandte Chemie*, 50, (2011), 6799 –6802.
17. Grassman TJ, Brenner MR, Gonzalez M, Carlin AM, Unocic RR, Dehoff RR, Mills MJ, Ringel SA, "Characterization of Metamorphic GaAsP/Si Materials and Devices for Photovoltaic Applications," *IEEE Transactions of Electron Devices*, 57, 10, (2010), 3361-3369.
16. Wang XQ, Fulvio PF, Baker GA, Veith GM, Unocic RR, Mahurin SM, Chi M, Dai S, "Direct Exfoliation of Natural Graphite into Micrometre Size Few Layers Graphene Sheets using Ionic Liquids," *Chemical Communications*, 46, 25, (2010), 4487-4489.
15. Phillips PJ, Unocic RR, Kovarik L, Mourer D, Wei D, Mills MJ, "Low Cycle Fatigue of a Ni-based Superalloy: Non-Planar Deformation," *Scripta Materialia,* 62, 10, (2010), 790-793.
14. Unocic RR, Unocic KA, Hayes RW, Daehn GS, Mills MJ, "A TEM Study of Creep Deformation Mechanisms in Allvac 718Plus," Superalloy 718 and Derivatives (2010), 607-615.
13. Unocic, KA, Unocic, RR, Pint, BA and Hayes, RW, "Effect of Microstucture and Environment on the High-Temperature Oxidation Behavior of Alloy 718Plus," Superalloy 718 and Derivatives (2010), 977-991.
12. Grassman TJ, Brenner MR, Rajagopalan S, Unocic RR, Dehoff RR, Mills MJ, Fraser HL, Ringel SA, "Control and Elimination of Nucleation-Related Defects in GaP/Si(001) Heteroepitaxy," *Applied Physics Letters*, 94, (2009), 232106.
11. Kovarik L, Unocic RR, Li J, Sarosi PM, Shen C, Wang Y, Mills MJ, "Microtwinning and Other Shearing Mechanisms at Higher Temperatures in Ni-base Superalloys," *Progress in Materials Science*, 54, (2009), 839-873.
10. Kovarik L, Unocic RR, Li J, Mills MJ, "The Intermediate Temperature Deformation of Ni-base Superalloys: Importance of Reordering," *Journal of Metals*, 61(2), (2009), 42-48.
9. Unocic RR, Viswanathan GB, Sarosi PM, Karthikeyan S, Mills MJ, "Mechanisms of Creep Deformation in Polycrystalline Ni-Base Disk Superalloys," *Materials Science and Engineering A*, 25-32, (2008), 483-484.
8. Unocic RR, Kovarik L, Shen C, Sarosi PM, Wang Y, Li J, Ghosh S, Mills MJ, "Deformation Mechanisms in Ni-base Superalloys at Higher Temperatures," 11th International Symposium on Superalloys (2008), 377-385.

7. Viswanathan GB, Karthikeyan S, Sarosi PM, Unocic RR, Mills MJ, "Microtwinning During Intermediate Temperature Creep of Polycrystalline Ni-Base Superalloys: Mechanisms and Modeling," *Philosophical Magazine*, 86, (29-31), (2006), 4823-4840.
6. Karthikeyan S, Unocic RR, Sarosi PM, Viswanathan GB, Mills MJ, "Modeling Microtwinning During Creep in Ni-based Superalloys," *Scripta Materialia,* 54, (2006), 1157-1162.
5. Sandhage KH, Snyder RL, Mahad G, Allan SH, Cai Y, Dickerson MB, Gaddis CS, Haluska MS, Shian S, Weatherspoon MR, Rapp RA, Unocic RR, Zalar FM, Zhang Y, Hildebrand M, Palenik BP, "Merging Biological Self-assembly with Synthetic Chemical Tailoring: The Potential for 3-D Genetically Engineered Micro/Nano-devices (3-D GEMS)," *International Journal of Applied Ceramic Technology*, 2 (4), (2005), 317-326.
4. Unocic RR, Zalar FM, Sarosi PM, Cai Y, Sandhage KH, "Anatase Assemblies from Algae: Coupling Biological Self-assembly of 3-D Nanoparticle Structures with Synthetic Reaction Chemistry," *Chemical Communications*, 7, (2004), 796-797.
3. Unocic RR, DuPont JN, "Process Efficiency Measurements in the Laser Engineered Net Shaping (LENS™) Process," *Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science,* 35B(1), (2003), 143-152.
2. Unocic RR, DuPont JN, "Composition Control in the Direct Laser-Deposition Process," *Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science*, 34B(4), 2003, 439-445.
1. Dickerson MB, Unocic RR, Guerra KT, Timberlake MJ, Sandhage KH, The fabrication of dense carbide/refractory metal composites of near net shape at modest temperatures by the PRIMA-DCP process, "Innovative Processing and Synthesis of Ceramics, Glasses, and Composites-Ceramics Transactions, 115, 25-31, 2000

Invited Presentations on In situ Microscopy (Total of 8):

8. "*In situ* Liquid S/TEM: Practical Aspects, Challenges, and Opportunities" Microscopy and Microanalysis Annual Meeting, Portland, OR, August 2015. Physical Sciences Tutorial Lectureship
7. "Quantitative Electrochemical Measurements in Electrochemical Cells: Battery Research," In situ electrochemical TEM workshop, Argonne National Laboratory, IL, June, 2014
6. "Application of In situ ec-S/TEM for Energy Storage Research"
   The Minerals, Metals, and Materials (TMS) Annual Meeting, San Diego, CA, February 2014.
5. "Advanced In situ ec-S/TEM for Electrochemical Energy Storage Research," The 14th Frontiers of Electron Microscopy in Materials Science (FEMMS) meeting, Lorne, Victoria, Australia, September 2013.
4. "Development and Application of *In Situ* Electrochemical Cell TEM Methods for Electrical Energy Storage Research," 3rd Hitachi Advanced Microscopy Workshop, Hitachi Electron Microscopy (HEMIC) Product Development Centre at the National Institute for Nanotechnology, Edmonton, Canada, June 2013.
3. "Application of *In Situ* Electrochemical Liquid Cells for Electrical Energy Storage Research," Conference on In situ and Correlative Electron Microscopy (CISCEM), Saarbrucken Germany, November 2012.
2. "Coupling EELS/EFTEM Imaging with Environmental Fluid Cell Microscopy," Microscopy and Microanalysis, Phoenix, AZ, August 2012.
1. "The Versatility of *In Situ* Environmental Fluid Cells for Materials Science Research,"
   Materials Science and Technology Conference, Columbus, OH, October 2011.

Oral Presentations on In situ Microscopy (Total of 9):

9. "Automated and Shaped-Controlled Liquid STEM Nanolithography, " Microscopy and Microanalysis Annular Meeting, Portland, OR, 2015.
8. "Synthesis of Nanostructured Materials with In situ and Electrochemical S/TEM," International Conference on Nanoscience and Technology, Vail, CO, 2014.
7. "Correlating Nanoparticle Nucleation and Growth Mechanisms with Cyclic Voltammetry and *in situ* ec-S/TEM Characterization," Spring MRS, San Francisco, CA, 2014.
6. "Tuning Electrodeposition Parameters for Tailored Nanoparticle Size, Shape, and Morphology: An *In*

Situ ec-STEM Investigation," Microscopy and Microanalysis Annual Meeting, Hartford, CT 2014.

5. "Quantitative *In Situ* Electrochemical Liquid Cell Characterization of SEI Formation in Lithium Ion Batteries," Microscopy and Microanalysis Annual Meeting, Indianapolis, IN, 2013.
4. "Practical Aspects of In situ Electrochemical Liquid Cell Microscopy," Fall MRS, Boston, MA, 2012.
3. "Use of *in-situ* TEM Characterization to Probe Electrochemical Processes in Li-ion Batteries," Spring MRS, San Francisco, CA, 2011.
2. "*In-situ* TEM Characterization of Electrochemical Processes in Energy Storage Systems," Microscopy and Microanalysis Annual Meeting, Nashville, TN, 2011.
1. "TEM and *In-situ* Liquid Cell Characterization of Copper Nanowire Growth Mechanisms," Microscopy and Microanalysis Annual Meeting, Nashville, TN, 2011.

Professional Activities: (Conference and Workshop Organizer)

2015 "Measuring Materials' Functionalities and Dynamics in Liquid and Gaseous Environments," Pre-meeting congress workshop at the Microscopy and Microanalysis Annual Meeting Portland, Oregon, August 2015. (Co-organizer)

2015 "Advances in Transmission Electron Microscopy and Spectroscopy of Energy-Related Materials," Symposium at the Microscopy and Microanalysis Annual Meeting Portland, Oregon, August 2015. (Symposium Co-organizer)

2015 "Advances in In situ Microscopy" at the 15th Frontiers of Electron Microscopy in Materials Science Lake Tahoe, CA, September 2015. (In situ Microscopy Session Co-organizer)

2015 "Beyond Lithium VIII," Oak Ridge National Laboratory, June 2015. (Local Program Committee)

2014 "Advanced Microscopy Workshop" at the Center for Nanophase Materials Science user meeting (August 2014). (Organizer).

2014 "In situ Electrochemical TEM" workshop at Argonne National Laboratory, June 2014. (Co-organizer)

2013 "Electron Microscopy in Liquids and Gases." Pre-meeting congress at the Microscopy and Microanalysis Annual Meeting, Indianapolis IN, August 2013. (Co-organizer)

Leadership Roles and Committee Membership:

2014-2016 Leader Elect for the Focused Interest Group: "Electron Microscopy in Liquids and Gases" (Microscopy Society of America)

2016-2018 Leader Elect for the Focused Interest Group: "Electron Microscopy in Liquids and Gases" (Microscopy Society of America)

2014-2015 Member of the Center of Nanophase Materials Science User Executive Committee (ORNL)

2013-2015 Alvin M. Weinberg Fellowship Committee Member (ORNL)

Professional Society Membership: Materials Research Society (MRS)**,** Microscopy Society of America (MSA), Electrochemical Society (ECS), The Minerals, Metals, and Materials Society (TMS)

Graduate and Postdoctoral Advisors:

Prof. Michael J. Mills, The Ohio State University (PhD/Postdoc Advisor)
Dr. Karren More, Oak Ridge National Laboratory (Alvin M. Weinberg Early Career Fellowship Mentor)

Ph.D. Students Advised:

Mr. Reed Wittman (University of Tennessee Knoxville-Chemical Engineering): "Zinc dendrite nucleation and growth mechanisms"
Mr. Jilai Ding (Georgia Institute of Technology-Materials Science): "Probing ionic conduction mechanisms"

Postdoctoral Researcher Advised:

Dr. Robert Sacci (Oak Ridge National Laboratory) Co-advised with Nancy Dudney
Dr. Xiahan Sang (Oak Ridge National Laboratory)