Guoying Chen
Curriculum Vitae

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RESEARCH INTERESTS

Develop innovative approaches to address complex and challenging technical problems in the field of energy conversion and storage technologies. Perform state-of-the-art diagnostic studies to reveal performance-limiting properties and phenomena in energy storage systems. Rationally design and synthesize advanced functional materials. Improve the safety of rechargeable lithium batteries.

EDUCATION

UC Berkeley & Berkeley Lab Leadership Development Program, Center for Executive Education, Hass School of Business, University of California at Berkeley (2012)
Ph.D. in Chemistry, The Pennsylvania State University, University Park, PA (2002)
M. Sc. in Organic Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, Shanghai, China (1997)
B. Sc. in Chemistry, Hangzhou University, Zhejiang, China (1994)

EMPLOYMENT

2014 - Present: Career Staff Scientist, Lawrence Berkeley National Laboratory

2008 - 2014: Career Research Scientist, Lawrence Berkeley National Laboratory

- Principal Investigator, DOE Batteries for Advanced Transportation Technologies (BATT) program focusing on the design and development of advanced lithium battery electrode materials. Established a new single-crystal based diagnostic approach to investigate performance-limiting properties and phenomena in electrode materials. This technique has wide applicability to the study of inorganic functional materials.
- Principal Investigator, DOE Advanced Battery Research (ABR) programs focusing on overcharge protection in PHEV batteries. A licensable technology was developed and a PCT application was submitted in 2013.
- Co-PI, DOE Integrated Laboratory/Industry Research Program (ILIRP) on the development of ceramic protective layers for Li metal anode.
- Group leader, BATT Spinel Focus Group to address the particle morphology effect on cathode performance and stability.

2005 - 2008: Career-Track Research Scientist, Lawrence Berkeley National Laboratory

- Lead scientist for the investigation on solid-state behaviors of olivine phosphate cathode materials and their implication on battery performance and safety. Obtained in-depth

knowledge on phase transition mechanism, electronic and ionic conductivities, solid solution formation and separation, and the effects of cation substitution, particle size and morphology. This work resulted in several highly cited papers in the literature.

- Evaluated the use of LiMg alloys as lithium battery anodes. This work established the foundation for patent application WO/2008/157067, LBNL Disclosure and Record of Invention IB-2253 "Ceramic-Metal Composites for Electrodes of Lithium Ion Batteries".
- Designed and fabricated *in situ* electrochemical cells that enable real-time monitoring of morphological evolution in cell components. The device has wide applicability to a variety of *in operando* studies.

2002 - 2005: Post-doctoral Chemist, Lawrence Berkeley National Laboratory

Developed and validated a novel method of using electroactive polymers for overcharge protection in rechargeable lithium batteries. This work led to a joint SBIR project with an industry partner.

PEER REVIEWED PUBLICATIONS (H-INDEX = 16)

40. H. Duncan, B. Hai, M. Leskes, C. P. Grey and G. **Chen**, "Relationships between Mn^{3+} Content, Structural Ordering, Phase Transformation and Kinetic Properties in $LiNi_xMn_{2-x}O_4$ Cathode Materials," *Chemistry of Materials*, **26**, 5374 (2014).

39. L. Cheng, E. Crumlin, W. Chen, R. Qiao, H. Hou, S. F. Lux, V. Zorba, R, Russo, R. Kostecki, K. Persson, W. Yang, J. Cabana, T. J. Richardson, G. **Chen**, and M. M. Doeff, "Origin of High Electrolyte-Electrode Interfacial Resistances in Lithium Cells Containing Garnet Type Solid Electrolytes" *Physical Chemistry Chemical Physics***, 16,** 18294 (2014).

38. B. Wang, T. J. Richardson and G. **Chen**, "Electroactive Polymer Fiber Separators for Stable and Reversible Overcharge Protection in Rechargeable Lithium Batteries," *Journal of the Electrochemical Society*, **161**, A1039 (2014).

37. L. Cheng, J. S. Park, H. Hou, V. Zorba, G. **Chen**, T. J. Richardson, J. Cabana, R. Russo, and M. M. Doeff, "Effect of Microstructure and Surface Impurity Segregation on the Electrical and Electrochemical Properties of Dense Al-substituted $Li_7La_3Zr_2O_{12}$" *Journal of Material Chemistry A*, **2**, 172 (2014).

36. B. Wang, T. J. Richardson and G. **Chen**, "Stable High-Rate Overcharge Protection for Rechargeable Lithium Batteries," *Phys. Chem. Chem. Phys*., **15** (18), 6849 (2013).

35. M. Doeff, G. **Chen**, J. Cabana, T. J. Richardson, A. Mehta, M. Shirpour, H. Duncan, C. Kim, K. C. Kam, and T. Conry, "Characterization of Electrode Materials for Lithium Ion and Sodium Ion Batteries using Synchrotron Techniques," *Journal of Visualized Experiments*, **81**, e50594 (2013).

34. U. Boesenberg, F. Meirer, Y. Liu, R. Dell'Anna, A. K. Shukla, T. Tyliszczak, G. **Chen**, J. C. Andrews, T. J. Richardson, R. Kostecki, and J. Cabana, "Mesoscale Phase Distribution in Single Particles of LiFePO4 Following Lithium Deintercalation," *Chemistry of Materials*, **25**, 1664 (2013).

33. L. Zhang, L. Cheng, J. Cabana, G. **Chen**, M. M. Doeff, and T. J. Richardson, "Effect of Lithium Borate Addition on the Physical and Electrochemical Properties of the Lithium Ion Conductor $Li_{3.4}Si_{0.4}P_{0.6}O_4$," *Solid State Ionics*, **231**,109 (2013).

32. B. Hai, A. K. Shukla, H. Duncan, and G. **Chen**, "Effect of Particle Surface Facets on the Kinetic Properties of $LiMn_{1.5}Ni_{0.5}O_4$ Cathode Material," *Journal of Material Chemistry A*, **1**, 759 (2013).

31. G. **Chen**, B. Hai, A. K. Shukla, and H. Duncan, "Impact of Initial Li Content on Kinetics and Stabilities of Layered $Li_{1+x}(Ni_{0.33}Mn_{0.33}Co_{0.33})_{1-x}O_2$," *Journal of the Electrochemical Society*, **159**, A1543 (2012).

30. G. **Chen**, A. Shukla, X. Song, and T. J. Richardson, "Improved Kinetics and Stabilities in Mg-Substituted $LiMnPO_4$," *Journal of Materials Chemistry*, **21**, 10126 (2011).

29. G. **Chen** and T. J. Richardson, "Thermal Instability of Olivine-type $LiMnPO_4$ Cathodes," *Journal of Power Sources*, **195**, 1221–1224 (2010).

28. J. Cabana, J. Shirakawa, G. **Chen**, T. J. Richardson, and C. P. Grey, "MAS NMR Study of the Metastable Solid Solutions Found in the $LiFePO_4/FePO_4$ System," C*hemistry of Materials*, **22**, 1249 (2010).

27. G. **Chen** and T. J. Richardson, "Overcharge Protection for 4 V Lithium Batteries at High Rates and Low Temperatures," *Journal of the Electrochemical Society*, **157**, A735 (2010).

26. G. **Chen** and T. J. Richardson, "Continuity and Performance in Composite Electrodes," *Journal of Power Sources*, **195**, 5387 (2010).

25. G. **Chen** and T. J. Richardson, "Solid Solution Phases in the Olivine-Type $LiMnPO_4/MnPO_4$ System," *Journal of the Electrochemical Society*, **156**, A756-A762 (2009).

24. G. **Chen** and T. J. Richardson, "Improving the Performance of Lithium Manganese Phosphate Through Divalent Cation Substitution," *Electrochemical and Solid State Letters*, **11**, A190-A194 (2008).

23. G. **Chen** and T. J. Richardson, "Solid Solution Lithium Alloy Cermet Anodes," *Journal of Power Sources*, **174**, 810 (2007).

22. G. **Chen**, X. Song, and T. J. Richardson, "Metastable Solid Solution Phases in the $LiFePO_4/FePO_4$ System," *Journal of the Electrochemical Society*, **154**, A627 (2007).

21. G. **Chen**, X. Song, and T. J. Richardson, "Electron Microscopy Study of the $LiFePO_4$ to $FePO_4$ Phase Transition," *Electrochemical and Solid State Letters*, **9**, A295 (2006).

20. G. **Chen** and T. J. Richardson, "Overcharge Protection for High Voltage Lithium Cells Using Two Electroactive Polymers," *Electrochemical and Solid State Letters*, **9**, A24 (2006).

19. G. **Chen**, K. E. Thomas-Alyea, J. Newman, and T. J. Richardson, "Characterization of an Electroactive Polymer for Overcharge Protection in Secondary Lithium Batteries," *Electrochimica Acta*, **50**, 4666 (2005).

18. G. **Chen**, G. V. Zhuang, T. J. Richardson, G. Liu, and P. N. Ross, "Anodic Polymerization of Vinyl Ethylene Carbonate in Li-Battery Electrolytes," *Electrochemical and Solid State Letters*, **8**, A344 (2005).

17. B. C. Chan, R. Liu, J. Krishnakumar, H. Zhang, G. **Chen**, T. E. Mallouk, and E. S. Smotkin, "Comparison of High-Throughput Electrochemical Methods for Testing Direct Methanol Fuel Cell Anode Electrocatalysts," *Journal of the Electrochemical Society*, **152**, A594 (2005).

16. G. V. Zhuang, G. **Chen**, J. Shim, X. Song, P. N. Ross, and T. J. Richardson, "Li_2CO_3 in $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ Cathodes and its Effects on Capacity and Power," *Journal of Power Sources*, **134**, 293 (2004).

15. G. **Chen** and T. J. Richardson, "Overcharge Protection for Rechargeable Lithium Batteries Using Electroactive Polymers," *Electrochemical and Solid State Letters*, **7**, A23 (2004).

14. K. E. Thomas-Alyea, J. Newman, G. **Chen**, and T. J. Richardson, "Design Principles for the Use of Electroactive Polymers for Overcharge Protection of Lithium-Ion Batteries," *Proceedings of the Electrochemical Society*, **2003-28**, 326 (2004).

13. K. E. Thomas-Alyea, J. Newman, G. **Chen**, and T. J. Richardson, "Modeling the Behavior of Electroactive Polymers for Overcharge Protection of Lithium Batteries," *Journal of the Electrochemical Society*, **151**, A509 (2004).

12. R. R. Díaz-Morales, R. Liu, E. Fachini, G. **Chen**, C. U. Segre, A. Martínez, C. Cabrera, and E. S. Smotkin, "XRD and XPS Analysis of As-Prepared and Conditioned DMFC Array Membrane Electrode Assemblies," *Journal of the Electrochemical Society*, **151**, A1314 (2004).

11. G. **Chen**,; C. C. Waraksa, H. Cho, D. D. Macdonald, and T. E. Mallouk, "Electrochemical Impedance Studies of Porous Oxygen Electrodes with Discrete Particles, Part I: Impedance of Oxide Catalyst Supports," *Journal of the Electrochemical Society*,**150**, E423 (2003).

10. C. C. Waraksa, G. **Chen**, D. D. Macdonald, T. E. Mallouk, "Electrochemical Impedance Studies of Porous Oxygen Electrodes with Discrete Particles, Part II: Transmission Line Modeling," *Journal of the Electrochemical Society*, **150**, E429 (2003).

9. G. **Chen**, S. R. Bare, and T. E. Mallouk, "Development of Supported Bifunctional Electrocatalysts for Unitized Regenerative Fuel Cells," *Journal of the Electrochemical Society*, **149**, A1092 (2002).

8. G. **Chen**, S. Sarangapani, and T. E. Mallouk, "Combinatorial Discovery of Bifunctional Oxygen Reduction-Water Oxidation Electrocatalysts for Regenerative Fuel Cells," *Catalysis Today*, **67**, 341 (2001).

7. G. **Chen**, J. T. Lean, M. Alcala, and T. E. Mallouk, "Modular Synthesis of π-Acceptor Cyclophane Derived from 1,4,5,8-Naphthalenetetracarboxylic Diimide and 1,5-Dinitronaphthalene," *Journal of Organic Chemistry*, **66**, 3027 (2001).

6. X. Lu and G. **Chen**, "An Efficient Diastereoselective Synthesis of Chiral Ferrocenyl Aldehydes," *Tetrahedron*, **54**, 12539 (1998).

5. X. Lu, G. **Chen**, and G. Guo, "Total Synthesis of Both Enantiomers of Melodorinol. Redetermination of Their Absolute Configurations," *Tetrahedron: Asymmetry*, **8**, 3067 (1997).

4. C. Xu, G. **Chen**, and X. Huang, "The Wittig Reaction of Stable Ylide with Aldehyde under Microwave Irradiation," *Synthesis Communication*, **25**, 2229 (1995).

3. C. Xu, G. **Chen**, and X. Huang, "Review: Microwave Technique in Organic Synthesis," *Organic Preparations and Procedures International*, Vol. **5** (1995).

2. C. Xu, G. **Chen**, and X. Huang, "Microwave Irradiated Dry Wittig Reaction," *Chinese Chemical Letters*, **6**, 467 (1995).

1. C. Xu, G. **Chen**, and X. Huang, "Preparation of Diethyl Arylanimomethylenemalonates under Microwave Irradiation," *Hechen Huaxue*, **3**, 53 (1995).

PATENTS/PATENT APPLICATIONS

4. "High-Rate Overcharge-Protection Separators for Rechargeable Lithium-Ion Batteries and The Methods of Making The Same," G **Chen** and T. J Richardson, PCT application submitted on US provisional patent 61/647,389 (2013)

3. "A Method to Remove Dissolved Ions from Water Using Composite Resin Electrodes," A. Gadgil, R. Kostecki, and G. **Chen**, LBNL Disclosure and Record of Invention IB-3121 **(**2012)

2. "Method of Screening Compositions for Electrocatalytic Activity in a Gas Diffusion Electrode," T. E. Mallouk, E. S. Smotkin, B. C. Chan, G. **Chen**, and R. Liu, U. S. Patent 6,913,849 (2005)

1. "Electrocatalyst Compositions," T. E. Mallouk, B. C. Chan, E. Reddington, A. Sapienza, G. **Chen**, E. S. Smotkin, B. Gurau, R. Viswanathan, R. Liu, U. S. Patent 6,284,402 (2001)

PRESENTATIONS

34. G. **Chen**, "Electroactive Separators for Safer and Longer Lasting Secondary Batteries," 2014 Molecular Foundry & NCEM Annual Users' Meeting, Berkeley, CA, August 2014 (invited).

33. G. **Chen**, "Design and Synthesis of Advanced High-Energy Cathode Materials," DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, June 2014.

32. G. **Chen**, "Reversible Overcharge Protection for Lithium-Ion Batteries," Next Generation Batteries 2014 Conference, San Diego, CA, April 2014 (invited).

31. S. Kuppan, H. Duncan, and G. **Chen** "Particle Design for Optimal Cathode Performance," Gordon Research Conferences, Ventura, CA, March 2014.

30. G. **Chen**, "Design and Synthesis of Advanced High-Energy Cathode Materials," 2014 DOE BATT Program Diagnostic Review Meeting, Berkeley, CA, March 2014.

29. G. **Chen**, "Making Safer Batteries: Preventing Overcharge," Berkeley Lab Science at the Theater, Berkeley, CA, February 2014 (invited).

28. G. **Chen**, "Reversible Overcharge Protection for Safer and Lasting Rechargeable Lithium Batteries," The 224th ECS Meeting, San Francisco, CA, October 2013.

27. G. **Chen** and T. Richardson, "Overcharge Protection for PHEV Batteries," Berkeley Energy and Resources Collaborative (BERC) Innovation Expo, Berkeley, CA, October 2013.

26. H. Duncan and G. **Chen**, "Morphology Design of High-Energy Cathode Materials for Rechargeable Li-Ion Batteries," Berkeley Energy and Resources Collaborative (BERC) Innovation Expo, Berkeley, CA, October 2013.

25. G. **Chen**, "Overcharge Protection for PHEV Batteries," DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, May 2013.

24. G. **Chen**, "Overcharge Protection for Safer Li-ion Batteries," Energy Storage and Distributed Resources Department Seminar, Berkeley, CA, February 2013.

23. G. **Chen**, B. Hai, and A. K. Shukla, "Impact of Particle Surface Facets on the Performance of $LiMn_{1.5}Ni_{0.5}O_4$," The 222th ECS Meeting, Honolulu, HI, October 2012.

22. H. Duncan, B. Hai, A.K. Shukla, and G. **Chen**, "Synthesis and Performance of $Li_{1.2}Ni_{0.13}Mn_{0.54}Co_{0.13}O_2$ Crystals," The 222th ECS Meeting, Honolulu, HI, October 2012.

21. G. **Chen** "Overcharge Protection for PHEV Batteries," DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, May 2012.

20. G. **Chen** "Spinel Focus Group: Morphology Effects on Interfacial Chemistry", US Drive Partnership Tech Team Meeting, Berkeley, CA, March 2012.

19. B. Hai, A. K. Shukla, H. Duncan, and G. **Chen** "Impact of $LiMn_{1.5}Ni_{0.5}O_4$ Crystal Surface Facets," Gordon Research Conferences, Ventura, CA, March 2012.

18. G. **Chen**, B. Hai, A. K. Shukla, and T. J. Richardson, "Crystal Studies of Spinel $LiNi_{0.5}Mn_{1.5}O_4$," The 220th ECS Meeting, Boston, Massachusetts, October 2011.

17. G. **Chen**, "Overcharge Protection for PHEV Batteries," 2011 DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, May 2011.

16. G. **Chen**, "Studies on Oxide Cathode Crystals," 2011 DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, May 2011.

15. G. **Chen**, B. Hai, A. K. Shukla, and T. J. Richardson, "Structure and Performance of Layered $Li_{1+x}M_{1-x}O_2$ Crystals," The 218th ECS Meeting, Las Vegas, Nevada, October 2010.

14. G. **Chen**, "Overcharge Protection," 2010 DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, June 2010.

13. G. **Chen**, "Performance and Safety of Olivines and Layered Oxides," 2010 DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting, Washington, DC, June 2010.

12. G. **Chen** and T. J. Richardson, "Electrochemical Reactivity of Metastable Li_xFePO_4 Phases," The 212th ECS Meeting, Washington, DC, October 2007.

11. G. **Chen**, X. Song, and T. J. Richardson, "Electron Microscopy and Spectroscopic Studies of Li_xFePO_4 Intermediate Phases," The 212th ECS Meeting, Washington, DC, October 2007.

10. G. **Chen**, "Improving Safety in Lithium-Ion Batteries," Director's Review of the Environmental Energy Technologies Division, Berkeley, California, September 2006.

9. G. **Chen**, X. Song, and T. J. Richardson, "Mechanistic Studies of Olivine-Type Li_xFePO_4," The 209th ECS Meeting, Denver, Colorado, May 2006.

8. G. **Chen** and T. J. Richardson, "A Versatile Approach to Overcharge Protection for Rechargeable Lithium Batteries," The 208th ECS Meeting, Los Angeles, California, October 2005.

7. G. **Chen** and T. J. Richardson, "Overcharge Protection for High Voltage Rechargeable Lithium Batteries," The 206th ECS Meeting, Honolulu, Hawaii, October 2004.

6. G. **Chen**, K. E. Thomas-Alyea, J. Newman, and T. J. Richardson, "Electroactive Polymers for Overcharge Protection in Rechargeable Lithium Batteries," The 21st International Battery Seminar and Exhibit, Fort Lauderdale, FL, March 2004.

5. G. **Chen**, K. E. Thomas, J. Newman, and T. J. Richardson, "Electronically Conductive Polymers for Overcharge Protection in Rechargeable Lithium Batteries," The 14th International Conference on Solid State Ionics, Monterey, CA, June 2003.

4. G. **Chen**, C. C. Waraksa, D. D. Macdonald, and T. E. Mallouk, "Electrochemical Impedance Spectroscopic Studies of Supported Electrocatalysts developed by a Combinatorial Method," The 202nd ECS Meeting, Salt Lake City, Utah, October 2002.

3. G. **Chen**, B. C. Chan, S. Sarangapani, and T. E. Mallouk, "Combinatorial Development of Supported Bifunctional Electrocatalysts for Unitized Regenerative Fuel Cells," The 222nd ACS National Meeting, Chicago, August 2001.

2. G. **Chen**, B. C. Chan, S. Sarangapani, and T. E. Mallouk, "Discovery of Bifunctional Catalysts for Polymer Electrolyte Membrane Regenerative Fuel Cells by Combinatorial Electrochemistry," The 220th ACS National Meeting, Washing, D. C., August 2000.

1. G. **Chen**, B. C. Chan, S. Sarangapani, and T. E. Mallouk, "Discovery of Bifunctional Catalysts for Polymer Electrolyte Membrane Regenerative Fuel Cells by Combinatorial Electrochemistry," Gordon Research Conference on Fuel Cells, Roger Williams University, Bristol, RI, July 2000.