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Profession Experience:

University of California, San Diego	Project Scientist	2020--Now	NanoEngineering
University of California, San Diego	Postdoctoral Scholar	2018--2020	NanoEngineering

Education Background:

University of California, San Diego	Ph.D.	2012--2017	Materials Sci. & Engr.
Chinese Academy of Sciences	M.S.	2009--2012	Materials Chem. & Phys.
NanKai University	B.S.	2005--2009	Physics

Research Interest and Technical Skills:

- Reaction mechanism study and novel synthesis route of electrode materials with high energy density for advanced and post lithium-ion batteries
- Materials diagnosis through multiple advanced characterizations such as SXRD, STEM/EELS, XPS, soft XAS, TXM, plasma-FIB, etc.
- Ab initio simulation of electronic and ionic transport properties of materials for energy storage and conversion

Research Experience:

- 2020--present Scientist Research on **Project of Developing High Energy Cathode Materials for Next-generation Li-ion Batteries from Umicore**, University of California, San Diego
- Composition and morphology design to identify the dependence of these factors on bulk structure reversibility and interfacial reactions with electrolytes
 - Engineering strategies development including elemental substitutions, surface coatings, and novel electrolyte compositions to produce the modified materials at large scale with energy density exceeding 350 Wh/kg at cell level
- 2018--present Postdoctoral Research on **Project of Co Free Cathode Materials and Their Novel Architectures from DOE**, University of California, San Diego
- New electrolyte formulation to suppress degradation in LNMO/graphite full cells
 - Feasibility of a Co free Li-ion cell with energy density exceeding 600 Wh/kg at cathode level
- 2012--2019 Graduate Research on **Project of Advanced Battery Materials Research (BMR) from DOE**, University of California, San Diego
- Morphology controlled synthesis for Li-rich material
 - Gas-solid interface modification of oxygen activity in layered oxide cathodes
- 2015--2018 Graduate Research on **Project of Development of Advanced Li Rich $x\text{Li}_2\text{MO}_3-(1-x)\text{LiMO}_2$ Composite Cathode for High Capacity Li Ion Batteries from AFOSR/AOARD**, University of California, San Diego
- Construction of atomistic models of layered composite cathode $x\text{Li}_2\text{MO}_3-(1-x)\text{LiMO}_2$
 - Determination of the optimal chemical composition for layered composite cathode $x\text{Li}_2\text{MO}_3-(1-x)\text{LiMO}_2$ and the optimal dopants for $x\text{Li}_2\text{MO}_3-(1-x)\text{LiMO}_2$ (M=Ni, Co, Mn, Ti, Al, Mo, etc.)
- 2015--2017 Graduate Research on **Project of Robust Affordable Next Generation Energy Storage System (RANGE) from ARPA-E**, University of California, San Diego

- Demonstration of average voltage depression less than 95% of the Li-rich layered oxide after 100 cycles at room temperature
- 2015-2016 Research Internship on **Project of Advanced Short Term Research Opportunity Program**, Oak Ridge National Laboratory (ORNL)
 - *In Situ* Microscopy for Lithiation of SnS₂
 - STEM/EELS study on oxygen evolution reaction activity of layered catalyst
- 2011–2012 Research Assistant on **Project of Next Generation Batteries Material from Natural Science Foundation**, Chinese Academy of Sciences
 - Gradient structure based on spinel LiNi_{0.5}Mn_{1.5}O₄
 - Microwave approach synthesis

Selected Peer-Reviewed Journal Publications: († authors with equal contribution, * corresponding author)

1. **M. Zhang**[†], B. Qiu[†], et al, “High pressure effect on structural and electrochemical properties of anionic redox-based lithium transition metal oxides”, **Matter**, 2020, 4, 164
2. Y. Li, M. J. Zuba, **M. Zhang**^{*}, Y. S. Meng^{*}, et al, “Regeneration of degraded Li-rich layered oxide materials through heat treatment-induced transition metal reordering”, **Energy Storage Materials**, 2020, 35, 99
3. B. Qiu[†], **M. Zhang**[†], et al, “Metastability and reversibility of anionic redox-based cathode for high-energy rechargeable batteries”, **Cell Reports Physical Science**, 2020, 1, 100028
4. W. Li, Y. Cho, **M. Zhang**^{*}, Y. S. Meng^{*}, et al, “Enabling high areal capacity for Co-free high voltage spinel materials in next-generation Li-ion batteries”, **Journal of Power Sources**, 2020, 473, 228579
5. E. Zhao[†], **M. Zhang**[†], J. Liu, X. Yu, Y. S. Meng, et al, “Local structure adaptability through multi cations for oxygen redox accommodation in Li-rich layered oxides”, **Energy Storage Materials**, 2020, 24, 384
6. H. Chung, A. Grenier, **M. Zhang**^{*}, Y. S. Meng^{*}, et al, “Comprehensive study of a versatile polyol synthesis approach for cathode materials for Li-ion batteries”, **Nano Research**, 2019, 12, 2238
7. C. Fang, J. Li, **M. Zhang**, Y. S. Meng, et al, “Quantifying inactive lithium in lithium metal batteries”, **Nature**, 2019, 572, 511
8. H. Hirsh, M. Olguin, H. Chung, **M. Zhang**^{*}, Y. S. Meng^{*}, et al, “Meso-structure controlled synthesis of sodium iron-manganese oxides cathode for low-cost Na-ion batteries”, **Journal of The Electrochemical Society**, 2019, 166 (12), A2528
9. **M. Zhang**, H.D. Liu, Z. Liu, C. Fang, and Y. S. Meng, “Modified coprecipitation synthesis of mesostructure-controlled Li-rich layered oxides for minimizing voltage degradation”, **ACS Applied Energy Materials**, 2018, 1(7), 3369
10. A. Singer, **M. Zhang**, S. Hy, et al, “Nucleation of dislocations and their dynamics in layered oxide cathode materials during battery charging”, **Nature Energy**, 2018, 3, 641
11. T. A. Wynn, C. Fang, **M. Zhang**, H. Liu, D. M Davies, et al, “Mitigating oxygen release in anionic-redox-active cathode materials by cationic substitution through rational design”, **Journal of Materials Chemistry A**, 2018, 6, 24651
12. J. Alvarado, M. A. Schroeder, **M. Zhang**, O. Borodin, et al, “A carbonate-free, sulfone-based electrolyte for high-voltage Li-ion batteries”, **Materials Today**, 2018, 21(4), 341
13. **M. Zhang**[†], K. Yin[†], et al, “In situ TEM observation of the electrochemical lithiation of N-doped anatase TiO₂ nanotubes as anodes for lithium-ion batteries”, **Journal of Materials Chemistry A**, 2017, 38, 20651
14. **M. Zhang**[†], B. Qiu[†], et al, “Understanding and controlling anionic electrochemical activity in high-capacity oxides for next generation Li-ion batteries”, **Chemistry of Materials**, 2017, 29(3), 908
15. K. Yin[†], **M. Zhang**[†], et al, “The formation of a self-assembled framework during lithiation of SnS₂, monitored by in situ microscopy”, **Accounts of Chemical Research**, 2017, 50 (7), 1513

16. X. Wang, **M. Zhang**, et al, "New insights on the structure of electrochemically deposited lithium metal and its solid electrolyte interphases via cryogenic TEM", **Nano Letters**, 2017, 17 (12), 7606
17. B. Qiu[†], **M. Zhang**[†], et al, "Gas-solid interfacial modification of oxygen activity in layered oxide cathodes for lithium-ion batteries", **Nature Communications**, 2016, 7, 12108
18. **M. Zhang**, A.C. MacRae, H.D. Liu, Y.S. Meng, "Investigation of anatase-TiO₂ as an efficient electrode material for magnesium-ion batteries", **Journal of the Electrochemical Society**, 2016, 163(10), A2368
19. S. Hy, H.D. Liu, **M. Zhang**, D. Qian, B.-J. Hwang, Y. S. Meng, "Performance and design considerations for the lithium excess layered oxide positive electrode materials for lithium ion batteries", **Energy & Environmental Science**, Advance Article, 2016, 9(6), 1931
20. Y. Shi, **M. Zhang**, D. Qian and Y. S. Meng, "Ultrathin Al₂O₃ coatings for improved cycling performance and thermal stability of LiNi_{0.5}Co_{0.2}Mn_{0.3}O₂ cathode material", **Electrochimica Acta**, 2016, 203(10), 154
21. **M. Zhang**, Y. Liu, Y. Xia, B. Qiu, J. Wang, Z. Liu, "Simplified co-precipitation synthesis of spinel LiNi_{0.5}Mn_{1.5}O₄ with improved physical and electrochemical performance", **Journal of Alloys and Compounds**, 2014, 598, 73
22. Y. Liu, **M. Zhang**, Y. Xia, B. Qiu, Z. Liu, X. Li, "One-step hydrothermal method synthesis of core-shell LiNi_{0.5}Mn_{1.5}O₄ spinel cathodes for Li ion batteries", **Journal of Power Sources**, 2014, 256, 66.
23. J. Wang, **M. Zhang**, C. Tang, Y. Xia, Z. Liu, "Microwave-irradiation synthesis of Li_{1.3}Ni_xCo_yMn_{1-x-y}O_{2.4} cathode materials for lithium ion batteries", **Electrochimica Acta** 2012,80,15
24. **M. Zhang**, J. Wang, Y. Xia, Z. Liu, "Microwave synthesis of spherical spinel LiNi_{0.5}Mn_{1.5}O₄ as cathode material for lithium-ion batteries", **Journal of Alloys and Compounds**, 2012, 518, 68

Patents and Book Chapter:

1. **M. Zhang**, B. Qiu, Y. S. Meng, et al. "Structural and voltage recovery in Li-rich layered oxides", provisional US patent, in application
2. Y. S. Meng, **M. Zhang**, et al. "Lithium excess cathode material and co-precipitation formation method", (PCT/US2016/062067)
3. Z. Liu, **M. Zhang**, et al. "Microwave synthesis of spinel LiNi_{0.5}Mn_{1.5}O₄ cathode materials for lithium-ion batteries", ZL201110131062.2
4. Z. Liu, **M. Zhang**, et al. "Synthesis of anion-doped transitional metal oxide as cathode materials for lithium-ion batteries", ZL201110131082.X
5. Z. Liu, **M. Zhang**, et al. "Synthesis of cathode materials for lithium-ion batteries using transitional metal carbonate as precursor", ZL201110214273.2
6. I.-H. Chu[†], **M. Zhang**[†], S. P. Ong, and Y. S. Meng, "Handbook of materials modeling-battery electrodes, electrolytes, and their Interfaces", Edited by: W. Andreoni and S. Yip (Springer Nature Switzerland AG 2018)

Conferences / Presentations:

1. **M. Zhang**, H.D. Liu, C. Fang, Y. S. Meng, "Minimize the voltage degradation in Li-rich layered oxide cathode materials by morphology control" **Materials Research Society Meeting**, 2016, Boston, U.S., Oral presentation.
2. **M. Zhang**, A. C. MacRae, Y. S. Meng, "Investigation of anatase-TiO₂ as an efficient electrode material for magnesium-ion batteries" **Electrochemical Society Meeting**, 2016, San Diego, U.S., Poster presentation.
3. **M. Zhang**, H.D. Liu, C. Fang, Y. S. Meng, "Morphological and surface structural changes during electrochemical cycling in Li-rich layered oxides for next generation Li-ion batteries" **Materials Research Society Meeting**, 2017, Phoenix, U.S., Oral presentation.
4. **M. Zhang**, H.D. Liu, Y. S. Meng, "Structure and voltage recovery driven by defects elimination in Li-rich layered oxide cathode materials" **Electrochemical Society Meeting**, 2018, Seattle, U.S., Oral presentation.

5. **M. Zhang**, M. Olguin, T. Wynn, Y. Li, Y. S. Meng, “Advanced characterization tools for probing anionic redox in layered cathode materials” **International Battery Association Meeting**, 2019, San Diego, U.S., Poster presentation.
6. **M. Zhang**, Y. S. Meng, “Toward the stable and reversible lattice oxygen redox in Li-rich layered oxides” **Electrochemical Society Meeting**, 2019, Atlanta, U.S., Postdoctoral Associate Research Award talk.
7. **M. Zhang**, Y. S. Meng, “Development of cryogenic techniques for characterizing energy storage materials in electrochemical process” **Microscopy & Microanalysis Meeting**, 2020, Virtual Meeting, U.S., Oral presentation.
8. **M. Zhang**, Y. S. Meng, “Three-dimensional imaging and interface analysis of battery materials via plasma FIB-SEM” **Electrochemical Society Meeting**, 2020, Virtual Meeting, U.S., Oral presentation.
9. **M. Zhang**, Y. S. Meng, “Advance characterization tools to study and develop stable anionic redox for high-energy rechargeable batteries” **Materials Research Society Meeting**, 2020, Virtual Meeting, U.S., Oral presentation.

Selected Awards and Synergistic Activities:

- a. Outstanding Programs in “100 Projects” of Creative Research, Nankai University, 2009
- b. Merit Student, Chinese Academy of Sciences, 2009-2010
- c. Vice President of Chinese Student Association, Ningbo Institute of Materials Technology and Engineering, 2009-2012
- d. Voluntary Work for 13th US-CHINA Electric Vehicle and Battery Technology Information Exchange, 2018, San Diego and International Battery Association Meeting, 2019, San Diego
- e. Battery Division Postdoctoral Associate Research Award of The Electrochemical Society (ECS), 2019
- f. Chair, Battery and Energy Technology Joint General Session, Electrochemical Society Meeting, 2019, Atlanta
- g. Symposium Organizer, Battery Student Slam, Electrochemical Society Meeting, 2021, Chicago
- h. Peer Reviewer for Energy & Environmental Science, Joule, ACS Nano, Chemistry of Materials, Journal of Materials Chemistry A, Nano Energy, Carbon, Journal of Power Sources, ACS Applied Materials & Interfaces, Electrochimica Acta, RSC Advances, etc.

Teaching Experience and Guest Lecture:

- a. Teaching Assistant for Energy Storage and Conversion – Nano 164 (undergrad) Nano261 (graduate)
- b. Teaching Assistant for Thermodynamics of Materials – Nano148 (undergrad)
- c. Teaching Assistant for Advanced Characterization for Nanosystems – Nano111 (undergrad) Nano230 (graduate)
- d. Guest Lecture on “First principles computation demo and Review”, “Advanced characterization for energy devices”, “The First Law of Thermodynamics”, “The Statistical Interpretation of Entropy”, “Phase Equilibrium in a one-C System”, “Phase Diagrams of Binary Systems”, “Phase Transformation in Ceramics”, “Introduction to X-ray Generation and Scattering Theory”, “Introduction to Electron Energy Loss Spectroscopy”, “Introduction to National Lab Facilities and Proposal Preparation”, etc.