

XIAOQING HE

Electron Microscopy Core Facility

University of Missouri-Columbia

W136 Veterinary Medicine Building, 1600 East Rollins Street

Columbia, MO 65211

Email: hexi@missouri.edu

EDUCATION

- 2012 Ph.D. Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences
- 2009 Master Department of Materials Science and Engineering, Hubei University
- 2006 Bachelor Electronic Science and Technology, Hubei University

PROFESSIONAL EXPERIENCE

2018. 09-present Adjunct Assistant Professor, Mechanical and Aerospace Engineering at University of Missouri-Columbia
2016. 06-present Senior Research Specialist, Electron Microscopy Core at University of Missouri-Columbia
2013. 08-2016. 05 Postdoc Research Associate, University of Illinois at Urbana-Champaign
2012. 07-2013. 07 Research Scientist, Institute of Geology and Geophysics, Chinese Academy of Sciences

SKILLS AND ABILITIES

- Proficient in operation of various transmission electron microscopes (TEM) and FIB-SEMs, including: FEI CM 12, FEI CM 200, FEI Tecnai F20, FEI Titan ChemiSTEM™, JEM-2010, JEM-2010F, JEM-2200FS, JEM-ARM 200CF; FEI Scios FIB, FEI Helios FIB.
- Have a rich experience of maintaining TEM and sample preparation, including traditional grinding, polishing, ion milling as well as focused ion beam (FEI Nanolab Helios 600i, FEI Scios) lift-out prep.
- Have a profound understanding of transmission electron microscopy (TEM): Electron diffraction (SAED, CBED), Bright field (BF) and Dark field (DF) imaging, High-resolution TEM, Scanning transmission electron microscopy (STEM), Electron

energy loss spectroscopy (EELS), Energy dispersive X-ray spectroscopy (EDX), Energy-filtered TEM, STEM-EELS, STEM-EDX, Spectrum-image, image and diffraction pattern simulation.

RESEARCH INTERESTS

Electron microscopy and spectroscopy and its applications to the study of functional materials: thin film solar cells, lithium ion cathode/anode materials, ferroelectrics, *etc.* Bridge the microstructures and properties of the functional materials and devices by extensive microscopy characterizations;

PUBLICATIONS

1. **X. Q. He**, C. Wen, X. F. Duan, and H. Chen, "Identification of atomic steps at AlSb/GaAs hetero-epitaxial interface using geometric phase method by high-resolution electron microscopy," *Materials Letters*, vol. 65, pp. 456-459, Feb 15 2011.
2. **X. He**, L. Gu, C. Zhu, Y. Yu, C. Li, Y.-S. Hu, H. Li, S. Tsukimoto, J. Maier, Y. Ikuhara, and X. Duan, "Direct Imaging of Lithium Ions Using Aberration-Corrected Annular-Bright-Field Scanning Transmission Electron Microscopy and Associated Contrast Mechanisms," *Materials Express*, vol. 1, pp. 43-50, Mar 2011.
3. **X. Q. He**, G. Brown, K. Demirkan, N. Mackie, V. Lordi, and A. Rockett, "Microstructural and chemical investigation of PVD-CdS/PVD-CuIn_{1-x}Ga_xSe₂ heterojunctions: a transmission electron microscopy study," *IEEE Journal of Photovoltaics*, vol. 4, pp. 1625-1629, Nov 2014.
4. **X. He**, J. Varley, P. Ercius, T. Erikson, J. Bailey, G. Zapalac, D. Poplavskyy, N. Mackie, A. Bayman, and V. Lordi, "Intermixing and Formation of Cu-Rich Secondary Phases at Sputtered CdS/CuInGaSe₂ Heterojunctions," *IEEE Journal of Photovoltaics*, vol. 6, pp. 1308-1315, 2016.
5. **X. He**, L. Gu, and A. Rockett, "Scanning transmission electron microscopy imaging of 180° ferroelectric domains and application to Ca_{0.28}Ba_{0.72}Nb₂O₆ single crystals," *Applied Physics Letters*, vol. 109, p. 262903, 2016.
6. **X. He**, T. Paulauskas, P. Ercius, J. Varley, J. Bailey, G. Zapalac, D. Poplavskyy, N. Mackie, A. Bayman, D. Spaulding, R. Klie, V. Lordi, and A. Rockett, "Cd doping at PVD-CdS/CuInGaSe₂ heterojunctions," *Solar Energy Materials and Solar Cells*, vol. 164, pp. 128-134, 2017.
7. **X. He** and L. Gu, "Direct Polarity Determination of Ferroelectric Ca_{0.28}Ba_{0.72}Nb₂O₆ Single Crystal by Combined Defocused Convergent Beam Electron Diffraction and Simulation," *Microscopy and Microanalysis*, vol. 23, pp. 1670-1671, 2017.
8. **X. He**, P. Ercius, J. Bailey, G. Zapalac, N. Mackie, A. Bayman, J. Varley, V. Lordi, A. Rockett, "Cu rich domains and secondary phases in PVD-CdS/PVD-CuIn_{1-x}Ga_xSe₂ heterojunctions," in: *Photovoltaic Specialist Conference (PVSC), 2015 IEEE 42nd, IEEE, 2015*, pp. 1-3.
9. **X. He**, P. Ercius, J. Varley, J. Bailey, G. Zapalac, T. Nagle, D. Poplavskyy, N. Mackie, A. Bayman, V. Lordi, and A. Rockett, "The role of oxygen doping on elemental intermixing at the PVD-CdS/Cu (InGa)Se₂ heterojunction," *Progress in Photovoltaics: Research and Applications*, <https://doi.org/10.1002/pip.3087>.
10. K. Zhang*, H. Wang*, **X. He***, Z. Liu, L. Wang, L. Gu, H. Xu, P. Han, S. Dong, C. Zhang, J.

- Yao, G. Cui, and L. Chen, "A hybrid material of vanadium nitride and nitrogen-doped graphene for lithium storage," *Journal of Materials Chemistry*, vol. 21, pp. 11916-11922, 2011. (*contribute equally)
11. X. Lu, L. Zhao, **X. He**, R. Xiao, L. Gu, Y.-S. Hu, H. Li, Z. Wang, X. Duan, L. Chen, J. Maier, and Y. Ikuhara, "Lithium Storage in Li₄Ti₅O₁₂ Spinel: The Full Static Picture from Electron Microscopy," *Advanced Materials*, vol. 24, pp. 3233-3238, Jun 26 2012.
 12. X. Lu, Y. Sun, Z. Jian, **X. He**, L. Gu, Y.-S. Hu, H. Li, Z. Wang, W. Chen, X. Duan, L. Chen, J. Maier, S. Tsukimoto, and Y. Ikuhara, "New Insight into the Atomic Structure of Electrochemically Delithiated O₃-Li(1-x)CoO₂ (0 ≤ x ≤ 0.5) Nanoparticles," *Nano Letters*, vol. 12, pp. 6192-6197, Dec 2012.
 13. Y.-Q. Wang, L. Guo, Y.-G. Guo, H. Li, **X.-Q. He**, S. Tsukimoto, Y. Ikuhara, and L.-J. Wan, "Rutile-TiO₂ Nanocoating for a High-Rate Li₄Ti₅O₁₂ Anode of a Lithium-Ion Battery," *Journal of the American Chemical Society*, vol. 134, pp. 7874-7879, May 9 2012.
 14. R. Wang, **X. He**, L. He, F. Wang, R. Xiao, L. Gu, H. Li, and L. Chen, "Atomic Structure of Li₂MnO₃ after Partial Delithiation and Re-Lithiation," *Advanced Energy Materials*, vol. 3, pp. 1358-1367, Oct 2013.
 15. C. Cao, X. Wang, Y. Cai, L. Sun, L. Tian, H. Wu, **X. He**, H. Lei, W. Liu, G. Chen, R. Zhu, and Y. Pan, "Targeted In Vivo Imaging of Microscopic Tumors with Ferritin- based Nanoprobes Across Biological Barriers," *Advanced Materials*, vol. 26, pp. 2566-2571, Apr 2014.
 16. Y. Cai, C. Cao, **X. He**, C. Yang, L. Tian, R. Zhu, and Y. Pan, "Enhanced magnetic resonance imaging and staining of cancer cells using ferrimagnetic H-ferritin nanoparticles with increasing core size," *International Journal of Nanomedicine*, vol. 10, pp. 2619-2634, 2015.
 17. S. Li, Q. Gao, J. Li, **X. He**, Q. Zhang, C. Li, Y. Shen, L. Gu, Y. Yao, Y. Wang, R. Yu, X. Duan, and Y. Ikuhara, "Revealing Antiphase Boundaries and Defects at Atomic Resolution in NaLaMgWO₆ Double Perovskites," *Materials Express*, vol. 2, pp. 264-264, Sep 2012.
 18. B. Qi, Y. Yu, **X. He**, L. Wu, X. Duan, and J. Zhi, "Series of transition metal-doped TiO₂ transparent aqueous sols with visible-light response," *Materials Chemistry and Physics*, vol. 135, pp. 549-553, Aug 15 2012.
 19. Z. Wang, Y. Yao, **X. He**, Y. Yang, L. Gu, Y. Wang, and X. Duan, "Investigation of Strain and Thin Film Relaxation in GexSi1-x/Si Strained-Layer Superlattice by Dark-Field Electron Holography," *Materials Transactions*, vol. 53, pp. 2019-2022, Nov 2012.
 20. K. Liang, **X. He**, Y. Qi, and C. Lu, "Growth and ferroelectric properties of Bi_{4-x}NdxTi₃O₁₂ single crystals," *Journal of Crystal Growth*, vol. 310, pp. 2471-2475, May 1 2008.
 21. Z. Chen, J. Liu, Y. Qi, D. Chen, S.-L. Hsu, A. R. Damodaran, **X. He**, A. T. N'Diaye, A. Rockett, and L. W. Martin, "180 degrees Ferroelectric Stripe Nanodomains in BiFeO₃ Thin Films," *Nano Letters*, vol. 15, pp. 6506-6513, Oct 2015.
 22. J. B. Varley, V. Lordi, **X. He**, and A. Rockett, "First principles calculations of point defect diffusion in CdS buffer layers: Implications for Cu(In, Ga)(Se, S)₂ and Cu₂ZnSn(Se, S)₄-based thin-film photovoltaics," *Journal of Applied Physics*, vol. 119, pp. 25703-25703, Jan 14 2016.
 23. J. Varley, **X. He**, A. A. Rockett, and V. Lordi, "The stability of Cd_{1-x}Zn_xOyS_{1-y} quaternary alloys assessed with first-principles calculations," *Acs Applied Materials & Interfaces*, vol. 9, pp. 5673-5677, 2017.
 24. R. V. Forest, B. E. McCandless, **X. He**, A. A. Rockett, E. Eser, K. D. Dobson, and R. W.

- Birkmire, "Diffusion of sodium in single crystal CuInSe₂," *Journal of Applied Physics*, vol. 121, p. 245102, 2017.
25. J. Varley, V. Lordi, **X. He**, and A. Rockett, "Exploring Cd-Zn-OS alloys for improved buffer layers in thin-film photovoltaics," *Physical Review Materials*, vol. 1, p. 025403, 2017.
 26. J. Y. Liao, T. W. Smith, R. R. Pandey, **X. Q. He**, C. C. Chusuei, and Y. C. Xing, "Substantially enhanced rate capability of lithium storage in Na₂Ti₆O₁₃ with self-doping and carbon-coating," *Rsc Advances*, vol. 8, pp. 8929-8936, 2018.
 27. B. L. MacDonald, D. Stalla, **X. He**, M. R. Maschmann, D. Emerson, and T. A. White, "Reconstructing Rock Art Fe-oxide Pigment Pyrotechnology Using In Situ SEM Heating Experiments," *Microscopy and Microanalysis*, vol. 24, pp. 2124-2125, 2018.
 28. M. V. Morrell, **X. He**, G. Luo, A. S. Thind, T. A. White, J. A. Hachtel, A. Y. Borisevich, J.-C. Idrobo, R. Mishra, and Y. Xing, "Significantly Enhanced Emission Stability of CsPbBr₃ Nanocrystals via Chemically Induced Fusion Growth for Optoelectronic Devices," *ACS Applied Nano Materials*, vol. 1, pp. 6091-6098, 2018.
 29. C. Wolenski, A. Wood, C. J. Mathai, **X. He**, J. McFarland, K. Gangopadhyay, S. Gangopadhyay, and M. R. Maschmann, "Nanoscale surface reactions by laser irradiation of Al nanoparticles on MoO₃ flakes," *Nanotechnology*, vol. 30, p. 045703, 2018.
 30. C. Zhang, C. Zhang, Y. Xie, J.-W. Su, **X. He**, J. D. Demaree, M. H. Griep, J. L. Atwood, and J. Lin, "A Supramolecular Coordination Polymer Derived Electrocatalyst for Oxygen Evolution Reaction," *Chemistry—A European Journal*, 2018.
 31. Y. Xie, C. Zhang, **X. He**, T. White, J. D. Demaree, M. Griep, and J. Lin, "Monolithic electrochemical cells for overall water splitting," *Journal of Power Sources*, vol. 397, pp. 37-43, 2018.
 32. Z. Yu, J. Wang, N. Zhang, J. Shin, Q. Zheng, S. Qu, **X. He**, A. Rockett, H. Yang, and P. V. Braun, "Dendritic nanostructured FeS₂-based high stability and capacity Li-ion cathodes," *Rsc Advances*, vol. 8, pp. 38745-38750, 2018.
 33. S. Ren, W. R. Shoemaker, X. Wang, Z. Shang, N. Klinghoffer, S. Li, M. Yu, **X. He**, T. A. White, and X. Liang, "Highly active and selective Cu-ZnO based catalyst for methanol and dimethyl ether synthesis via CO₂ hydrogenation," *Fuel*, vol. 239, pp. 1125-1133, 2019.
 34. Z. Wang, W. Hu, Z. Kang, **X. He**, Z. Cai, and B. Deng, "Arsenate adsorption on iron-impregnated ordered mesoporous carbon: Fast kinetics and mass transfer evaluation," *Chemical Engineering Journal*, vol. 357, pp. 463-472, 2019.
 35. Y. Xie, C. Zhang, **X. He**, J.-W. Su, T. Parker, T. White, M. Griep, and J. Lin, "Copper-promoted nitrogen-doped carbon derived from zeolitic imidazole frameworks for oxygen reduction reaction," *Applied Surface Science*, vol. 464, pp. 344-350, 2019.
 36. J. Torres, Z. Buck, H. Kaiser, **X. He**, T. White, M. Tyagi, R. Winholtz, F. Hansen, K. Herwig, and H. Taub, "A neutron scattering and electron microscopy study of the structure, wetting, and freezing behavior of water near hydrophilic CuO-nanostructured surfaces," *Journal of Applied Physics*, vol. 125, p. 025302, 2019.
 37. A. Laudari, A. Pickett, F. Shahdipour-Sandvik, K. Hogan, J. E. Anthony, **X. He**, and S. Guha, "Textured Poling of the Ferroelectric Dielectric Layer for Improved Organic Field - Effect Transistors," *Advanced Materials Interfaces*, p. 1801787, 2019.

CONTRIBUTED PRESENTATIONS, PROCEEDINGS and PATENTS

1. Microstructural and chemical investigation of PVD-CdS/ PVD-CuIn_{1-x}Ga_xSe₂ heterojunctions: a transmission electron microscopy study,
X. Q. He, G. Brown, K. Demirkan, N. Mackie, V. Lordi, and A. Rockett
40th IEEE Photovoltaic Specialists Conference, Denver, Colorado, June, 2014. (Oral presentation)
2. Cu rich domains and second phase in PVD-CdS/ PVD-CuIn_{1-x}Ga_xSe₂ heterojunctions,
Xiaoqing He, Peter Ercius, Jeff Bailey, Geordie Zapalac, Neil Mackie, Atiye Bayman, Joel Varley, Vincenzo Lordi, Angus Rockett
42nd IEEE Photovoltaic Specialists Conference, New Orleans, Louisiana, June, 2015. (Oral presentation)
3. Exploring Cd-Zn-O-S alloys for optimal buffer layers in thin-film photovoltaics,
J Varley, **X He**, N Mackie, A Rockett, V Lordi
American Physics Society March Meeting 2015.
4. Cd-Zn-O-S alloys for optimal buffer layers in thin-film photovoltaics,
Joel B Varley, **Xiaoqing He**, Neil Mackie, Angus A Rockett, Vincenzo Lordi
Proc. SPIE 9561, Thin Films for Solar and Energy Technology VII, 95610A (October 5, 2015);
5. Design of optimal buffer layers for CuInGaSe₂ thin-film solar cells,
Vincenzo Lordi, Joel B Varley, **Xiaoqing He**, Angus A Rockett, Jeff Bailey, Geordie H Zapalac, Neil Mackie, Dmitry Poplavskyy, Atiye Bayman
SPIE Optics+ Photonics for Sustainable Energy, 2016.
6. N. Mackie, G. Zapalac, W. Zhang, J. F. Corson, **X. He**, A. Rockett, J. Varley, and V. Lordi,
Hexagonal phase epitaxial cadmium sulfide on copper indium gallium selenide for a photovoltaic junction, ed: US Patent App. 15/153,478, 2016.
7. Gnilitskiy, V. Gruzdev, **X. He**, O. Sergaeva, P. Ji, T. White, and Y. Zhang, "Sub-surface Layer of Silicon Single Crystal Periodically Nanostructured by Near-infrared Femtosecond Laser Pulses," in Conference on Lasers and Electro-Optics/Pacific Rim, 2018, p. W4B. 3.

JOURNAL REFEREE

IEEE Journal of Photovoltaics

Journal of Alloys and Compounds

Journal of Applied Physics

Journal of Physics: Condensed Matter

Journal of Renewable and Sustainable Energy

Materials Express

Thin solid films

Chinese Physics B

44th IEEE Photovoltaic Specialists Conference

7th edition of the World Conference on Photovoltaic Energy Conversion

46th IEEE Photovoltaic Specialists Conference