Last updated: 10/01/2021

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Assistant Professor

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EDUCATION

Ph.D., Materials Engineering, Department of Chemical and Materials Engineering, University of Alberta, Canada (05.2018); Supervisor: Thomas Thundat
Thesis: Direct-current Triboelectricity Generation by Electron Tunneling Transport

M.S., Materials Science, Department of Materials Science and Engineering Shanghai University, China (12.2014); Supervisor: Zhiyu (Jerry) Hu
Thesis: Shape-controlled Synthesis of Ultrafine Pt Nanodendrite and the Study of its Multifunction

B.E., Materials Science and Engineering, Nanchang University, China (06,2012)

PROFESSIONAL EXPERIENCE

Assistant Professor, Department of Mechanical and Aerospace Engineering, Sep 2020-present
Affiliated Faculty, RENEW (Research and Education in eNergy, Environment and Water) Institute
University at Buffalo, Buffalo, NY
Postdoctoral Fellow, Department of Chemical and Biological Engineering Sep 2018-Aug 2020
University at Buffalo, Buffalo, NY

HONORS AND AWARDS

Microsystem and Nanoengineering (MINE) Young Scientist Award, Nature Springer, Aug 2020
Best Scientific Research Abstract, NanoSymposium on SPM, US, Dec 2019
National Award for Excellent Graduate Students Abroad, Government of China, Dec 2019
Mary Louise Imrie Graduate Student Award, University of Alberta, May 2018
Alberta Innovates–Technology Futures Graduate Student Scholarship, Government of Canada, May 2015
Captain Thomas Farrell Greenhalgh Memorial Graduate Scholarship, University of Alberta, March 2015
Second Prize, International Contest of Applications in Nano/Micro Technology, April 2013

Research Interest:

- Understanding and manipulating quantum effects at dynamic materials interfaces
- Energy solution for self-powered portable/wearable devices
- Electro-mechanical/opto-mechanical/opto-electro-mechanical coupling
- Multi-materials/ Multi-functional additive manufacturing for energy application
- Scanning Probe Microscopy (SPM): instrumentation development and application

PUBLICATIONS

Total Peer Reviewed Journal Publications: 30; under review: 3
First/co-first/corresponding authored: 14
Citation: 735, H-index: 14, i10-index: 17
Google scholar: https://scholar.google.com/citations?user=-3sNBB8AAAAJ&hl=en

Refereed Journal Articles

(*: corresponding author; §: co-first author _: graduate student supervised)

In Review:

1. Matthew Benner§, Yang, Ruizhe§, Lin, leqi, Maomao Liu, and Huamin Li and **Liu, J.***. "Elucidating the fundamental roles of interfacial layer on tribovoltaic carrier excitation and direct-current transport."
2. Guangming Liu, **Liu, J.***, Dou, Wenjie*. "Quantum dynamics study of tribovoltaic effect at semiconductor sliding interface."
3. Kumar, Abhishek; Zhao, Yaoli; Mohammadi, Mohammad Moein; **Liu, J.**; Thundat, Thomas; Swihart, Mark 'Palladium nanosheet-based dual gas sensors for sensitive room temperature hydrogen and carbon monoxide detection'

Published

Since Faculty Appointment

1. Yang, Ruizhe, Matthew Benner, Zipeng Guo, Chi Zhou, and **Liu, J.***. "High-Performance Flexible Schottky DC Generator via Metal/Conducting Polymer Sliding Contacts." ***Advanced Functional Materials*** (2021): 2103132.
2. Yang, Ruizhe, Ran Xu, Wenjie Dou, Matthew Benner, Qing Zhang, and **Liu, J.***. "Semiconductor-based dynamic heterojunctions as an emerging strategy for high direct-current mechanical energy harvesting." ***Nano Energy*** (2021): 83, 105849.
3. Kumar, Abhishek, Mohammad Moein Mohammadi, Yaoli Zhao, Yang Liu, **Liu, J.**, Thomas Thundat, and Mark T. Swihart. "Reduced Graphene Oxide-Wrapped Palladium Nanowires Coated with a Layer of Zeolitic Imidazolate Framework-8 for Hydrogen Sensing." ***ACS Applied Nano Materials*** (2021): 4 (8), 8081-8093.
4. Tian, Yanpei, Lijuan Qian, Xiaojie Liu, Alok Ghanekar, **Liu, J.**, Thomas Thundat, Gang Xiao, and Yi Zheng. "High-temperature and Abrasion Resistant Metal-insulator-metal Metamaterials." ***Materials Today Energy*** (2021): 21, 100725.
5. Mohammadi, Mohammadmoein; Kumar, Abhishek; **Liu, J.**; Liu, Yang; Thundat, Thomas; Swihart, Mark, 'Hydrogen Sensing at Room Temperature Using Flame-synthesized Palladium-decorated Crumpled Reduced Graphene Oxide Nanocomposites', ***ACS Sensors*** 5, no. 8 (2020): 2344-2350
6. Yanpei Tian, Xiaojie Liu, Shilin Xu, Andrew Caratenuto, Ying Mu, Ziqi Wang, Fangqi Chen, Ruizhe Yang, **Liu, J.**, Marilyn Minus, Yi Zheng, 'Recyclable and efficient ocean biomass-derived hydrogel photothermal evaporator for thermally-localized solar desalination' ***Desalination***, 2021

Prior to Faculty Appointment

7. Feng Hu, Lu An, Xin Qian, Changning Li, **Liu, J.**, Guibin Ma, Yong Hu, Yulong Huang, Yuzi Liu, Thomas Thundat, Gang Chen, Shenqiang Ren, 'Transparent and Flexible Thermal Insulation Window Material', ***Cell Report Physical Science*** 1, no. 8 (2020): 100140.
8. Oruganti, S.K., Liu, F., Paul, D., **Liu, J**., Malik, J., Feng, K., Kim, H., Liang, Y., Thundat, T. and Bien, F. 'Experimental Realization of Zenneck type Wave-based non-Radiative, non-coupled Wireless power transmission'. ***Scientific Reports***, 10.1 (2020): 1-12.
9. **Liu, J.**, Zhang YQ., Chen, J., Bao, R., Jiang K., Khan, F., Goswami, A., Li, Z., Liu, FF., Feng, K., Luo, JL., Thundat, T. 'Separation and quantum tunneling of photo-generated carriers using tribo-induced field', ***Matter***, 2019, 1 (3), 650-660

10. **Liu, J.**, Liu, F., Bao, R., Jiang, K., Khan, F., Li, Z., Peng, H., Chen, J., Alodhayb, A. and Thundat, T. 'Scaled-up direct-current generation in MoS_2 multilayers-based moving heterojunctions', ***ACS Applied Materials & Interfaces***, 2019, 11,38, 35404-35409
11. **Liu, J.**, Cheikh, M.I., Bao, R., Peng, H., Liu, F., Li, Z., Jiang, K., Chen, J. and Thundat, T. 'Tribo-tunneling direct-current generator by carbon aerogel/silicon multi-nanocontacts', ***Advanced Electronic Materials***, 2019, 1900464
12. **Liu, J.**, Jiang K., Nguyen L. Li, Z, Thundat, T. 'Interfacial friction-induced electronic excitation mechanism for tribo-tunneling current generation', ***Materials Horizons***, 2019, (6), 1020 - 1026
13. Li, Z., Jiang, K., Khan, F., **Liu, J.**, Passion, A., Thundat, T. 'Anomalous interfacial stress generation during sodium intercalation/extraction in MoS_2 thin film anodes', ***Science Advances***, 2019, 5(1), eaav28
14. **Liu, J.**, Goswami, A. Jiang, K., Khan, F., Kim, S., McGee, R., Li, Z., Hu, Z., Lee, J. and Thundat, T. 'Direct-current triboelectricity generation by sliding-Schottky nanocontact on MoS_2 multilayers', ***Nature Nanotechnology***, 2018, 13 (2), 112
15. **Liu, J.**, Miao, M., Jiang, K., Khan, F., Goswami, A., McGee, R., Li, Z., Nguyen, L., Hu, Z., Lee, J., Cadien, K. and Thundat, T. 'Sustained electron tunneling at unbiased metal-insulator-semiconductor triboelectric contacts', ***Nano Energy***, 2018, 48, 320–326

2017

16. Zhang, Y.-Q.; Tao, H.-B.; **Liu, J.**; Sun, Y.-F.; Chen, J.; Hua, B.; Thundat, T.; Luo, J.-L.'A rational design for enhanced oxygen reduction: Strongly coupled silver nanoparticles and engineered perovskite nanofibers', ***Nano Energy,*** 2017, 38, 392-400.
17. Chen, Q.; **Liu, J**.; Thundat, T.; Gray, M. R.; Liu, Q. 'Spatially resolved organic coating on clay minerals in bitumen froth revealed by atomic force microscopy adhesion mapping', ***Fuel*** **2017,** 191, 283-289.

2016

18. **Liu, J.**; Prashanthi, K.; Li, Z.; McGee, R. T.; Ahadi, K.; Thundat, T. 'Strain-induced electrostatic enhancements of $BiFeO_3$ nanowire loops', ***Physical Chemistry Chemical Physics*** **2016,** 18, (33), 22772-22777.
19. Li, Z.; **Liu, J.**; Jiang, K.; Thundat, T. 'Carbonized nanocellulose sustainably boosts the performance of activated carbon in ionic liquid supercapacitors', ***Nano Energy*** **2016,** 25, 161-169.
20. Zhang, H.; Ye, F.; Hu, Y.; **Liu, J**.; Zhang, Y.; Wu, Y.; Hu, Z. 'The investigation of thermal properties on multilayer Sb_2Te_3/Au thermoelectric material system with ultra-thin Au interlayers', ***Superlattices Microstruct.*** **2016,** 89, 312-318.
21. Wu, Y.; Lin, Z.; Tian, Z.; Han, C.; **Liu, J**.; Zhang, H.; Zhang, Z.; Wang, Z.; Dai, L.; Cao, Y. 'Fabrication of Microstructured thermoelectric Bi_2Te_3 thin films by seed layer assisted electrodeposition', ***Mater. Sci. Semicond. Process.*** **2016,** 46, 17-22.
22. Tian, Z.; Wang, X.; **Liu, J.**; Lin, Z.; Hu, Y.; Wu, Y.; Han, C.; Hu, 'Power factor enhancement induced by Bi and Mn co-substitution in Na_xCoO_2 thermoelectric materials', Z. ***J. Alloys Compd.*** **2016,** 661, 161-167.

2015

23. **Liu, J.**; Gaikwad, R.; Hande, A.; Das, S.; Thundat, T. 'Mapping and Quantifying Surface Charges on Clay Nanoparticles', ***Langmuir*** **2015,** 31, (38), 10469-10476.
24. Lin, Z.; Wang, X.; **Liu, J.**; Tian, Z.; Dai, L.; He, B.; Han, C.; Wu, Y.; Zeng, Z.; Hu, Z. 'On the role of localized surface plasmon resonance in UV-Vis light irradiated Au/TiO_2 photocatalysis systems:

pros and cons', ***Nanoscale*** **2015,** 7, (9), 4114-4123.

25. Dai, L.; **Liu, J.**; Han, C.; Wang, Z.; Zhang, Y.; Hu, Z. 'Influence of electronic transmission on the electrical transport properties in metal–semiconductor contacts', ***physica status solidi (a)*** **2015,** 212, (12), 2791-2797.

2014

26. **Liu, J.**; Wang, X.; Lin, Z.; Cao, Y.; Zheng, Z.; Zeng, Z.; Hu, Z. 'Shape-Controllable Pulse Electrodeposition of Ultrafine Platinum Nanodendrites for Methanol Catalytic Combustion and the Investigation of their Local Electric Field Intensification by Electrostatic Force Microscope and Finite Element Method', ***Electrochimica Acta*** **2014,** 136, 66-74.
27. **Liu, J.**; Lin, Z.; Wang, X.; Zeng, Z.; Hu, Z. 'Modeling the morphology-dependent optical properties of single and dimer Pt nanodendrite structures', ***EPL (Europhysics Letters)*** **2014,** 108, (3), 37004.
28. Zheng, Z.; Wang, X.; **Liu, J.**; Xiao, J.; Hu, Z. 'Si doping influence on the catalytic performance of Pt/TiO_2 mesoporous film catalyst for low-temperature methanol combustion', ***Appl. Surf. Sci.*** **2014,** 309, 144-152.
29. Yang, X.; Wang, X.; **Liu, J.**; Hu, Z. 'Power factor enhancement in Na_xCoO_2 doped by Bi', ***J. Alloys Compd.*** **2014,** 582, 59-63.
30. Chen, Y.; **Liu, J. (contributed equally)**; Wang, X.; Wang, W.; Zeng, Z.; Hu, Z. 'Chemical Composition and Surface Roughness of AlO_x-Controlled Activity of Pt/AlO_x Thin Film Catalysts for Methanol Oxidation Reaction', ***Catal. Lett.*** **2014,** 144, (10), 1696-1703

Patents

1. Liu, J, Thundat, T. 3D structured mechanical-photovoltaic direct-current generator (PCT/US2021/028032 filed 19 April 2021)
2. Liu, J, Tsai, K., Thundat, T. One-piece mechanical energy harvesting and storage device (U.S. provisional patent)

TECHNICAL PRESENTATIONS

Invited Talks

1. "Mists of contact electrification: history, current trends, and future", Oct 2021, Corning lnc.
2. "Next-generation Mechanical Energy Harvesting Based on Semiconductor", Jan 2021, Shanghai Jiao Tong University, China
3. "Nanomechanics for Next-generation, Semiconductor-based Mechanical Energy Harvesting", Sep 2020. Rochester Institute of Technology, USA
4. "Materials and nanomechanics for semiconductor-based Mechanical Energy Harvesting", Aug 2020, Microsystems & Nanoengineering Forum, Nature Springer
5. "Tribo-photovoltaic effect" 2019 NanoScientific Symposium on SPM, Albany, NY, USA
6. "Tribo-tunneling transport", 2018.12, Jiangxi University of Science and Technology, Ganzhou
7. "Tribo-photovoltaic effect" 2018.12, Zhejiang University, Hangzhou, China
8. "Direct-current generation in metal-MoS_2 sliding contacts", 2017.12, Tianjin University, Tianjin
9. "Direct-current generation in MIS sliding systems", 2017.12, Sun Yat-sen University, Guangzhou

Conference Presentation (Presenter underlined; *: graduate student)

1. Liu, J. 'Flexible Dynamic Schottky Direct-current (DC) Generator', 5th International Conference on Nanoenergy and Nanosystems 2021 (NENS2021), Oct 2021, Online, (**Invited**)
2. Liu, J. "Revealing Fundamental Multi-Scale, Multi-Physics Interaction in Contact Electrification", *2021Materials Research Society (MRS) Spring*, April 2021, Online, (**Invited and Session Chair**)
3. Ruizhe, Yang.*, Liu, J., 'Towards Flexible and Scaled-up Schottky Direct Current Generator' *2021Materials Research Society (MRS) Spring*, April 2021, Online
4. Liu, J. "Next-generation Mechanical Energy Harvesting Based on Semiconductor*", the 5th International Emerging Electronics Conference (ICEE-2020) IEEE-ICEE*, Dec 2020, India (**Invited**)
5. Liu, J. "Tribo-tunneling effect for energy harvesting", *SPIE 2020 Micro- and Nanotechnology Sensors, Systems, and Applications Conference*, April 2020, LA, USA (**Invited**)
6. Liu, J. "Tribo-photovoltaic effect" *2019 Materials Research Society (MRS) Spring*, Dec 2019, Boston, USA
7. Liu, J. 'Semiconductor-based tribo-tunneling direct-current nanogenerator', 4th International Conference on Nanoenergy and Nanosystems 2019 (NENS2019), June 2019, Beijing, China (**Invited**)
8. Liu, J. 'Carrier transport mechanism of direct-current triboelectricity generation in metal-semiconductor frictional system', 4th International Conference on Nanogenerator and Piezotronics (NGPT 2018), May 2018, Seoul, South Korea
9. Liu, J. "Electrical-SPM for energy harvesting research", 2018 Materials Research Society (MRS) Spring, April 2018, Phoenix, USA
10. Liu, J. 'A new physical mechanism for triboelectric power harvesting explored by conductive-atomic force microscopy (C-AFM)', 2018 Materials Research Society (MRS) Spring, April 2018, Phoenix, USA
11. Liu, J. 'Shape-controllable Synthesis and Investigation of Multifunctional Metal Nanodendrites', 16th Annual Conference of the Chinese Society of Micro-Nano Technology (CSMNT 2014), Sep. 2014, Chengdu, China

GRADUATE STUDENTS

Dissertations/Theses Directed

M.S. degrees (theses/projects)

1. Matthew Banner, MS (project), Sep 2020-May 2021, "Friction-induced Electronic Excitation and Transport in In-plane and Vertical Layer Structure"; now working at Plug Power Inc.

Dissertation/Theses in Progress

1. Ruizhe Yang, PhD, Sep 2020-present, degree expected June 2024
2. Leqi Lin, PhD, Sep 2021-present, degree expected June 2025

Project in Progress

3. Vashin Gautham Nanjangud Thyagaraja, MS (project), Sep 2021-present, degree expected June 2023

UNDERGRADUATE STUDENTS

1. Monica Cortes, BE (Class of 2024), (with Zimmer Scholarship)
2. Renoy Ranjith BE (Class of 2023)
3. Kai Wang (Class of 2022)

Last updated: 10/01/2021

PROFESSIONAL ACTIVITIES

Leadership

Chair, Session NM09.03: Nanogenerators and Piezotronics, MRS, Spring Conference, 2021

Other Service

Review Editor: 2019-present, Frontiers in Chemistry

Poster judge: 2021ASME Undergraduate Research and Design Expo

Journal Reviewer: Nature Communications; Joule; Nano Energy; Journal of Materials Chemistry A; Materials Today Physics; ACS Applied Materials & Interfaces; RCS Advances; Journal of Electronic Materials; Journal of Vacuum Science and Technology; Applied Physics Letters; Intelligent and Converged Network; Journal of The Electrochemical Society; Microsystems & Nanoengineering; AIP Advances; ACS Books; ACS Applied Nano Materials; Microscopy and Microanalysis; Materials Science in Semiconductor Processing

Membership in Professional Societies: Materials Research Society (MRS) and American Society of Mechanical Engineers (ASME)

University Activities

Department: MAE faculty advisor to 5 undergraduate students; Poster competition judge (2020)

University: NSF I-corp UB site program (2019)