

HUI CAI

Assistant Professor
Department of Physics
University of California, Merced
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EDUCATION

- 2014-2018 **Arizona State University**
Ph.D. in Materials Science and Engineering
Advisor: Prof. Sefaattin Tongay
Dissertation: “Layer Structured Gallium Chalcogenides: Controlled Synthesis and Emerging Properties”
- 2011-2014 **Zhejiang University**, Hangzhou, China
M.S. in Materials Science and Engineering
Advisor: Prof. Jingyun Huang
Thesis: “Synthesis and p-Type Doping of ZnOSe Alloy Thin Films”
- 2007-2011 **Yanshan University**, Qinhuangdao, China
B.E. in Materials Physics

WORK EXPERIENCE

- 2020-present **University of California, Merced**
Assistant Professor
Department of Physics
- 2020-present **Lawrence Berkeley National Laboratory**
Faculty Scientist
Materials Sciences Division
- 2018-2020 **Oak Ridge National Laboratory**
Postdoctoral Associate in the Center for Nanophase Materials Sciences
Research: Two-dimensional quantum materials and devices
Supervisor: Dr. David B Geohegan

HONORS & AWARDS

- | | |
|--|--------------------------|
| Outstanding Graduate Student Research Award | Arizona State University |
| Graduate College Completion Fellowship | Arizona State University |
| First-class Award of Honor for Graduate | Zhejiang University |
| Graduate of Merit/Triple-A graduate | Zhejiang University |
| National First Prize in China Undergraduate Mathematical Contest in Modeling | Yanshan University |

PROFESSIONAL ACTIVITIES

Journal referee: Advanced Materials, Advanced Functional Materials, Applied Physics Letters, Journal of Applied Physics, ACS Applied Materials & Interfaces, The Journal of Physical Chemistry, Journal of Materials Research, SCIENCE CHINA Materials

PUBLICATIONS: (39 refereed journal papers, 1193 citations, h-index: 19)

1. 2D Palladium Diselenide with Strong in-Plane Optical Anisotropy and High Mobility Grown by Chemical Vapor Deposition

Yiyi Gu*, **Hui Cai***, Jichen Dong, Yiling Yu, Anna N. Hoffman, Chenze Liu, Akinola Oyedele, Yu-Chuan Lin, Alexander A. Puretzky, Gerd Duscher, Matthew F. Chisholm, Philip D. Rack, Christopher M. Rouleau, Xiangmin Meng, Feng Ding, David B. Geohegan, Kai Xiao

Advanced Materials, 32(19), 1906238(2020). *These authors contributed equally.

2. Synthesis and Emerging Properties of 2D Layered III-VI Metal Chalcogenides
Hui Cai, Yiyi Gu, Yu-Chuan Lin, Yiling Yu, David B. Geohegan, Kai Xiao
Applied Physics Reviews, 6, 041312(2019)
• **Editor's pick**
3. Abnormal Band Bowing Effects in Phase Instability Crossover Region of GaSe_{1-x}Te_x Nanomaterials
Hui Cai, Bin Chen, Mark Blei, Shery L.Y. Chang, Kedi Wu, Houlong Zhuang, and Sefaattin Tongay
Nature Communications, 9, 1927(2018)
• **Featured in Editors' Highlights of Nature Communications**
4. Synthesis of Highly Anisotropic Semiconducting GaTe Nanomaterials and Emerging Properties Enabled by Epitaxy
Hui Cai, Bin Chen, Gang Wang, Emmanuel Soignard, Afsaneh Khosravi, Marco Manca, Xavier Marie, Shery LY Chang, Bernhard Urbaszek, Sefaattin Tongay
Advanced Materials, 29(8), 1605551(2017)
• **Featured in PhysOrg**: "Synthesis of pseudo-1D semiconductor provides insight into anisotropic 2D materials"
5. Band Engineering by Controlling vdW Epitaxy Growth Mode in 2D Gallium Chalcogenides
Hui Cai, Emmanuel Soignard, Can Ataca, Bin Chen, Changhyun Ko, Toshihiro Aoki, Anupum Pant, Xiuqing Meng, Shengxue Yang, Jeffrey Grossman, Frank D Ogletree, Sefaattin Tongay
Advanced Materials, 28(34), 7375(2016)
6. Exciton Pumping Across Type-I Gallium Chalcogenide Heterojunctions
Hui Cai, Jun Kang, Hasan Sahin, Bin Chen, Aslihan Suslu, Kedi Wu, Francois Peeters, Xiuqing Meng, Sefaattin Tongay
Nanotechnology, 27(6), 065203(2016)
7. Realization of P-type Se-N co-Doped ZnO Films by Radio-Frequency Magnetron Sputtering
Hui Cai, Hongbin Xu, Zhizhen Ye and Jingyun Huang
Materials Letters, 108, 183(2013)
8. Phase Transition across Anisotropic NbS₃ and Direct Gap Semiconductor TiS₃ at Nominal Titanium Alloying Limit
Kedi Wu, Mark Blei, Bin Chen, Lei Liu, **Hui Cai**, Cassandra Brayfield, David Wright, Houlong Zhuang, Sefaattin Tongay
Advanced Materials, 32(17), 2000018(2020)
9. Passivation of Layered Gallium Telluride by Double Encapsulation with Graphene
Elisha Mercado, Yan Zhou, Yong Xie, Qinghua Zhao, **Hui Cai**, Bin Chen, Wanqi Jie, Sefaattin Tongay, Tao Wang, Martin Kuball
ACS Omega, 4(19), 18002-18010(2019)
10. Tunable electronic structure in gallium chalcogenide van der Waals compounds
Brian Shevitski, Søren Ulstrup, Roland J Koch, **Hui Cai**, Sefaattin Tongay, Luca Moreschini, Chris Jozwiak, Aaron Bostwick, Alex Zettl, Eli Rotenberg, Shaul Aloni
Physical Review B, 100(16), 165112(2019)
11. Valley-dependent exciton fine structure and Autler-Townes doublets from Berry phases in monolayer MoSe₂
Chaw-Keong Yong, M. Iqbal Bakti Utama, Chin Shen Ong, Ting Cao, Emma C. Regan, Jason Horng, Yuxia Shen, **Hui Cai**, Kenji Watanabe, Takashi Taniguchi, Sefaattin Tongay, Hui Deng, Alex Zettl, Steven G. Louie & Feng Wang
Nature Materials, 18, 1065–1070(2019)
12. A Dielectric-Defined Lateral Heterojunction in a Monolayer Semiconductor
M Iqbal Bakti Utama, Hans Kleemann, Wenyu Zhao, Chin Shen Ong, H Felipe, Diana Y Qiu, **Hui Cai**, Han Li, Rai Kou, Sihan Zhao, Sheng Wang, Kenji Watanabe, Takashi Taniguchi, Sefaattin Tongay, Alex Zettl, Steven G Louie, Feng Wang
Nature Electronics, 2, 60–65(2019)

13. Ultimate Control over Hydrogen Bond Formation and Reaction Rates for Scalable Synthesis of Highly Crystalline vdW MOF Nanosheets with Large Aspect Ratio
*Yuxia Shen, Bohan Shan, **Hui Cai**, Ying Qin, Ashutosh Agarwal, Dipesh B Trivedi, Bin Chen, Lei Liu, Houlong Zhuang, Bin Mu, Sefaattin Tongay*
Advanced Materials, 30(52), 1802497(2018)
14. Biexcitonic Optical Stark Effects in Monolayer Molybdenum Diselenide
*Chaw-Keong Yong, Jason Horng, Yuxia Shen, **Hui Cai**, Alex Wang, Chan-Shan Yang, Chung-Kuan Lin, Shilong Zhao, Kenji Watanabe, Takashi Taniguchi, Sefaattin Tongay, and Feng Wang*
Nature Physics, 14, 1092(2018)
15. Observation of Bosonic Condensation in an Atomically Thin Crystal Embedded in a Hybrid MoSe₂-GaAs Microcavity
*Max Waldherr, Nils Lundt, Martin Klaas, Simon Betzold, Matthias Wurdack, Vasilij Baumann, Eliezer Estrecho, Anton Nalotov, Evgenia Cherotchenko, **Hui Cai**, Elena A. Ostrovskaya, Alexey V. Kavokin, Sefaattin Tongay, Sebastian Klemmt, Sven Höfling and Christian Schneider*
Nature Communications, 9, 3286(2018)
16. Imaging of Pure Spin-Valley Diffusion Current in WS₂/WSe₂ Heterostructures
*Chenhao Jin, Jonghwan Kim, M. Iqbal Bakti Utama, Emma C. Regan, Hans Kleemann, **Hui Cai**, Yuxia Shen, Matthew James Shinner, Arjun Sengupta, Kenji Watanabe, Takashi Taniguchi, Sefaattin Tongay, Alex Zettl, Feng Wang*
Science, 360(6391), 893-896(2018)
17. Optical Spectroscopy of Excited Exciton States in MoS₂ Monolayers in van der Waals Heterostructures
*C Robert, MA Semina, F Cadiz, M Manca, E Courtade, T Taniguchi, K Watanabe, **H Cai**, S Tongay, B Lassagne, P Renucci, T Amand, X Marie, MM Glazov, B Urbaszek*
Physical Review Materials, 2(1), 011001(2018)
18. Environmental Stability of 2D Anisotropic Tellurium Containing Nanomaterials: Anisotropic to Isotropic Transition
*Sijie Yang, **Hui Cai**, Bin Chen, Changhyun Ko, V. Ongun Özçelik, D. Frank Ogletree, Claire E. White, Yuxia Shen and Sefaattin Tongay*
Nanoscale, 9, 12288-12294(2017)
19. Excitonic Linewidth Approaching the Homogeneous Limit in MoS₂-Based van der Waals Heterostructures
*F Cadiz, E Courtade, C Robert, G Wang, Y Shen, **H Cai**, T Taniguchi, K Watanabe, H Carrere, D Lagarde, M Manca, T Amand, P Renucci, S Tongay, X Marie, B Urbaszek*
Physical Review X, 7, 021026(2017)
20. Observation of Ultralong Valley Lifetime in WSe₂/MoS₂ Heterostructures
*Jonghwan Kim, Chenhao Jin, Bin Chen, **Hui Cai**, Tao Zhao, Puiyee Lee, Salman Kahn, Kenji Watanabe, Takashi Taniguchi, Sefaattin Tongay, Michael F. Crommie and Feng Wang*
Science Advances, 3(7), e1700518(2017)
21. Ultrathin Ternary Semiconductor TlGaSe₂ Phototransistors with Broad-Spectral Response
*Shengxue Yang, Minghui Wu, Hui Wang, **Hui Cai**, Li Huang, Chengbao Jiang and Sefaattin Tongay*
2D Materials, 4(3), 035021(2017)
22. Controlling Structural Anisotropy of Anisotropic 2D Layers in Pseudo-1D/2D Material Heterojunctions
*Bin Chen, Kedi Wu, Aslihan Suslu, Sijie Yang, **Hui Cai**, Aliya Yano, Emmanuel Soignard, Toshihiro Aoki, Katia March, Yuxia Shen, Sefaattin Tongay*
Advanced Materials, 29(34), 1701201(2017)
23. Domain Architectures and Grain Boundaries in Chemical Vapor Deposited Highly Anisotropic ReS₂ Monolayer Films
*Kedi Wu, Bin Chen, Sijie Yang, Gang Wang, Wilson Kong, **Hui Cai**, Toshihiro Aoki, Emmanuel Soignard, Xavier Marie, Aliya Yano, Aslihan Suslu, Bernhard Urbaszek, Sefaattin Tongay*
Nano Letters, 16(9), 5888(2016)
24. Self-Driven Photodetector and Ambipolar Transistor in Atomically Thin GaTe-MoS₂ p-n vdW Heterostructure
*Shengxue Yang, Cong Wang, Can Ataca, Yan Li, Hui Chen, **Hui Cai**, Aslihan Suslu, Jeffrey C Grossman, Chengbao*

- Jiang, Qian Liu, Sefaattin Tongay*
ACS applied materials & interfaces, 8(4), 2533(2016)
25. Gate-Tunable Diode-like Current Rectification and Ambipolar Transport in Multilayer van der Waals ReSe₂/WS₂ p–n Heterojunctions
Cong Wang, Shengxue Yang, Wenqi Xiong, Congxin Xia, Hui Cai, Bin Chen, Xiaoting Wang, Xinzheng Zhang, Zhongming Wei, Sefaattin Tongay, Jingbo Li, Qian Liu
Physical Chemistry Chemical Physics, 18(40), 27750(2016)
26. Unusual Dimensionality Effects and Surface Charge Density in 2D Mg(OH)₂
Aslihan Suslu, Kedi Wu, Hasan Sahin, Bin Chen, Sijie Yang, Hui Cai, Toshihiro Aoki, Seyda Horzum, Jun Kang, Francois M Peeters, Sefaattin Tongay
Scientific reports, 6, 20525(2016)
27. Fundamentals of Lateral and Vertical Heterojunctions of Atomically Thin Materials
Anupum Pant, Zafer Mutlu, Darshana Wickramaratne, Hui Cai, Roger K Lake, Cengiz Ozkan, Sefaattin Tongay
Nanoscale, 8(7), 3870(2016)
28. Enhancing Light Emission Efficiency without Color Change in Post-Transition Metal Chalcogenides
Cong Wang, Shengxue Yang, Hui Cai, Can Ataca, Hui Chen, Xinzheng Zhang, Jingjun Xu, Bin Chen, Kedi Wu, Haoran Zhang, Luqi Liu, Jingbo Li, Jeffrey C Grossman, Sefaattin Tongay, Qian Liu
Nanoscale, 8(11), 5820(2016)
29. Highly Efficient Gas Molecule-Tunable Few-Layer GaSe Phototransistors
Shengxue Yang, Qu Yue, Hui Cai, Kedi Wu, Chengbao Jiang, Sefaattin Tongay
Journal of Materials Chemistry C, 4(2), 248(2016)
30. Engineering Excitonic Dynamics and Environmental Stability of Post-Transition Metal Chalcogenides by Pyridine Functionalization Technique
Xiuqing Meng, Anupum Pant, Hui Cai, Jun Kang, Hasan Sahin, Bin Chen, Kedi Wu, Sijie Yang, Aslihan Suslu, FM Peeters, Sefaattin Tongay
Nanoscale, 7(40), 17109(2015)
31. Synthesis of ZnO–CuO Porous Core–Shell Spheres and their Application for Non-enzymatic Glucose Sensor
Bin Cai, Yu Zhou, Minggang Zhao, Hui Cai, Zhizhen Ye, Lei Wang, Jingyun Huang
Applied Physics A, 118(3), 989-996(2015)
32. Texture Surfaces and Etching Mechanism of ZnO:Al Films by a Neutral Agent for Solar Cells
Qingjun Jiang, Jianguo Lu, Jie Zhang, Yuliang Yuan, Hui Cai, Chuanjia Wu, Rujie Sun, Bin Lu, Xinhua Pan, Zhizhen Ye
Solar Energy Materials and Solar Cells, 130, 264-271(2014)
33. A Perovskite-type KNbO₃ Nanoneedles Based Biosensor for Direct Electrochemistry of Hydrogen Peroxide
Bin Cai, Minggang Zhao, Ye Wang, Yu Zhou, Hui Cai, Zhizheng Ye, Jingyun Huang
Ceramics International, 40(6), 8111-8116(2014)
34. Introducing Heterojunction Barriers into Single Kinked Nanowires for the Probe-free Detection of Proteins and Intracellular Recording
Minggang Zhao, Bin Cai, Ye Ma, Hui Cai, Jingyun Huang, Xinhua Pan, Haiping He, Zhizhen Ye
Nanoscale, 6(8), 4052-4057(2014)
35. The Application of Porous ZnO 3D Framework to Assemble Enzyme for Rapid and Ultrahigh Sensitive Biosensors
Minggang Zhao, Yu Zhou, Bin Cai, Ye Ma, Hui Cai, Zhizhen Ye, Jingyun Huang
Ceramics International, 39(8), 9319-9323(2013)
36. Mango Core Inner Shell Membrane Template-Directed Synthesis of Porous ZnO Films and Their Application for Enzymatic Glucose Biosensor
Yu Zhou, Lei Wang, Zhizhen Ye, Minggang Zhao, Hui Cai, Jingyun Huang

Applied Surface Science, 285, 344-349(2013)

37. Rhombus-shaped Co_3O_4 Nanorod Arrays for High-Performance Gas Sensor
*Zhen Wen, Liping Zhu, Weimin Mei, Liang Hu, Yaguang Li, Luwei Sun, **Hui Cai**, Zhizhen Ye*
Sensors and Actuators B: Chemical, 186, 172-179(2013)
38. Wavelength Tunable Photoluminescence of $\text{ZnO}_{1-x}\text{S}_x$ Alloy Thin Films Grown by Reactive Sputtering
*Hongbin Xu, Liping Zhu, Jie Jiang, **Hui Cai**, Wenfeng Chen, Liang Hu, Yanmin Guo, Zhizhen Ye*
Journal of Applied Physics, 114(8), 083522(2013)
39. A Fluorine-mediated Hydrothermal Method to Synthesize Mesoporous Rhombic ZnO Nanorod Arrays and their Gas Sensor Application
*Zhen Wen, Liping Zhu, Lei Li, Luwei Sun, **Hui Cai**, Zhizhen Ye*
Dalton Transactions, 42(44), 15551-15554(2013)

PRESENTATIONS

1. Poster presentation: Abnormal Band Bowing Effects in Phase Instability Crossover Region of $\text{GaSe}_{1-x}\text{Te}_x$ Nanomaterials. 2018 MRS Spring Meeting & Exhibit, Phoenix, AZ, USA
2. Oral presentation: Layer Structured Gallium Chalcogenides: Controlled Synthesis and Engineering of Their Bandgap and Optical Properties. 2017 MRS Spring Meeting & Exhibit, Phoenix, AZ, USA
3. Poster presentation: Studying the Exciton Complexes in 2-Dimensional Gallium Chalcogenides. 2016 MRS Spring Meeting & Exhibit, Phoenix, AZ, USA

TEACHING EXPERIENCE

Arizona State University

- MSE 215: Materials Synthesis (Instructor of the lab session)
- MSE 451: Materials Characterization Lab (Teaching assistant)
- MSE 523: Structural and Mechanical Properties of Materials (Teaching assistant)