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Endowed Associate Professor

Department of Electronic Engineering
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Education

- ***Ph.D., Materials Science and Engineering, Massachusetts Institute of Technology, 2012***
  Thesis advisor: Lionel C. Kimerling

- ***B. Eng., Materials Science and Engineering, Tsinghua University, 2007***

Professional Experiences

- ***Endowed Associate Professor, Dept. Electronic Engineering, Tsinghua University, present***
  also affiliated with: IDG/McGovern Institute for Brain Research at Tsinghua University

- ***Postdoctoral Associate, University of Illinois at Urbana-Champaign, 2012–2015***
  Advisor: John A. Rogers

Research Interests

- Non-conventional Optoelectronics for Biomedical Applications
- Optical Neural Interfaces
- Biocompatible and Biodegradable Photonics

Teaching Experience

- Leading Lecturer at Tsinghua

- 20230313 "Foundation of Solid State Physics"
- 80230992 "Principles of Micro- and Nanofabrication for Electronic and Photonic Devices"
- 80231001 "Laboratory of Micro- and Nanofabrication for Electronic and Photonic Devices"
- 60230072 "Academic Writings and Presentations for Electrical Engineering"

- Worked as a guest lecturer and a teaching assistant for multiple courses at Tsinghua, MIT and UIUC
- Supervised undergraduate and graduate students at MIT, UIUC and Tsinghua

Publications

Peer-Reviewed Journals:

Google Scholar: https://scholar.google.com/citations?hl=en&user=bS9skH4AAAAJ

#co-first author, *corresponding author

1. Y. Huang#, Y. Cui#, H. Deng#, J. Wang, R. Hong, S. Hu, H. Hou, Y. Dong, H. Wang, J. Chen, L. Li, Y. Xie, P. Sun, X. Fu, L. Yin, W. Xiong, S.-H. Shi, M. Luo, S. Wang*, X. Li*, **X. Sheng***, "Bioresorbable Thin-Film Silicon Diodes for the Optoelectronic Excitation and Inhibition of Neural Activities", *Nature Biomedical Engineering* **XX**, XX (2023).
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3. H. Ding*, Y. Peng, G. Lv, Y. Xie, J. Chen, Z. Shi, Y. Deng, L. Yin, J. Yang, Y. Wang, **X. Sheng***, "Heterogeneous Integration of Thin-Film Organic and Inorganic Devices for Optical based Bioelectrical and Chemical Sensing", *IEEE Journal of Selected Topics in Quantum Electronics* **29**, 5200107 (2023) (***Invited***).
4. Y. Deng, M. Zhao, Y. Ma, S. Liu, M. Liu, B. Shen, R. Li, H. Ding, H. Cheng, **X. Sheng**, W. Fu, Z. Li, M. Zhang, L. Yin*, "A Flexible and Biomimetic Olfactory Synapse with Gasotransmitter-Mediated Plasticity", *Advanced Functional Materials* **XX**, XXX (2023).
5. F. Dai, Q. Geng, T. Hua, **X. Sheng**, L. Yin*, "Organic biodegradable piezoelectric materials and their potential applications as bioelectronics", *Soft Science* **XX**, XXX (2023) (***Invited***).
6. Q. Zhou, X. Fu, J. Xu, S. Dong, C. Liu, D. Cheng, C. Gao, M. Huang, Z. Liu, X. Ni, R. Hua, H. Tu, H. Sun, Q. Shen, B. Chen, J. Zhang, L. Zhang, H. Yang, J. Hu, W. Yang, W. Pei, Q. Yao, **X. Sheng**, J. Zhang*, W.Z. Yang*, W.L. Shen*, "Hypothalamic Warm-Sensitive Neurons Require TRPC4 Channel for Detecting Internal Warmth and Regulating Body Temperature in Mice", *Neuron* **111**, 387–404 (2023).
7. L. Li#, L. Lu#, Y. Ren#, G. Tang#, Y. Zhao, X. Cai, Z. Shi, H. Ding, C. Liu, D. Cheng, Y. Xie, H. Wang, X. Fu, L. Yin, M. Luo*, **X. Sheng***, "Colocalized, Bidirectional Optogenetic Modulations in Freely Behaving Mice with a Wireless Dual-Color Optoelectronic Probe", *Nature Communications* **13**, 839 (2022).
8. X. Cai#, L. Li#, W. Liu, N. Du, Y. Zhao, Y. Han, C. Liu, Y. Yin, X. Fu, D. Sheng, L. Yin, L. Wang, P. Wei*, **X. Sheng***, "A Dual-Channel Optogenetic Stimulator Selectively Modulates Distinct Defensive Behaviors", *iScience* **25**, 103681 (2022) (***Invited***).
9. H. Ding*, G. Lv, X. Cai, J. Chen, Z. Cheng, Y. Peng, G. Tang, Z. Shi, Y. Xie, X. Fu, L. Yin, J. Yang, Y. Wang, **X. Sheng***, "An Optoelectronic Thermometer based on Microscale Infrared-to-Visible Conversion Devices", *Light: Science & Applications* **11**, 130 (2022).
10. H. Wang, J. Tian, B. Lu, Y. Xie, P. Sun, L. Yin, Y. Wang, **X. Sheng***, "Degradation Study of Thin-Film Silicon Structures in a Cell Culture Medium", *Sensors* **22**, 802 (2022) (***Invited***).
11. R. Nazempour#, B. Zhang#, Z. Ye, L. Yin, X. Lv, **X. Sheng***, "Emerging Applications of Optical Fiber-Based Devices for Brain Research", *Advanced Fiber Materials* **4**, 24–42 (2022) (***Invited Review***).
12. D. Kong, Y. Zhang, D. Cheng, E. Wang, K. Zhang, H. Wang, K. Liu, L. Yin*, **X. Sheng***, "Heteroepitaxy of Large-Area, Monocrystalline Lead Halide Perovskite Films on Gallium Arsenide", *ACS Applied Materials & Interfaces* **14**, 52508–52515 (2022).
13. D. Kong#, K. Zhang#, J. Tian, L. Yin*, **X. Sheng***, "Biocompatible and Biodegradable Light-Emitting Materials and Devices", *Advanced Materials Technologies* **7**, 2100006 (2022) (***Invited Review***).

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15. S. Lu, Z. Fu, F. Li, K. Weng, L. Zhou, L. Zhang, Y. Yang, H. Qiu, D. Liu, W. Qing, H. Ding, **X. Sheng**, M. Chen, X. Tang, L. Duan, W. Liu, L. Wu, Y. Yang, H. Zhang*, J. Li, "Beyond a Linker: The Role of Photochemistry of Crosslinkers in the Direct Optical Patterning of Colloidal Nanocrystals", *Angewandte Chemie* **134**, e202202633 (2022).
16. L. Li, G. Tang, Z. Shi, H. Ding, C. Liu, D. Cheng, Q. Zhang, L. Yin, Z. Yao, L. Duan, D. Zhang, C. Wang, M. Feng, Q. Sun, Q. Wang, Y. Han, L. Wang, Y. Luo, **X. Sheng***, "Transfer-Printed, Tandem Microscale Light-Emitting Diodes for Full-Color Displays", *Proceedings of the National Academy of Sciences USA* **118**, e2023436118 (2021).
17. H. Ding, G. Lv, Z. Shi, D. Cheng, Y. Xie, Y. Huang, L. Yin, J. Yang, Y. Wang, **X. Sheng***, "Optoelectronic Sensing of Biophysical and Biochemical Signals based on Photon Recycling of a micro-LED", *Nano Research* **14**, 3208–3213 (2021) (***Invited***) (***Front Cover***).
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19. Y. Yang, M. Wu, A. Vázquez-Guardado, A. Wegener, J. Grajales-Reyes, Y. Deng, T. Wang, R. Avila, J. Moreno, S. Minkowicz, V. Dumrongprechachan, J. Lee, S. Zhang, A. Legaria, Y. Ma, S. Mehta, D. Franklin, L. Hartman, W. Bai, M. Han, H. Zhao, W. Lu, Y. Yu, **X. Sheng**, A. Banks, X. Yu, Z. Donaldson, R. Gereau, C. Good, Z. Xie*, Y. Huang*, Y. Kozorovitskiy*, J. A Rogers*, "Wireless multilateral devices for optogenetic studies of individual and social behaviors", *Nature Neuroscience* **24**, 1035–1045 (2021).
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29. R. Zhou, M. Feng, J. Wang, Q. Sun*, J. Liu, S. Zhang, M. Ikeda, T. Liu, Z. Huang, **X. Sheng**, H. Yang, "InGaN-based lasers with an inverted ridge waveguide heterogeneously integrated on Si(100)", *ACS Photonics* **7**, 2636–2642 (2020).
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and Chemical Dependent Hydrolysis Mechanisms of Silicon Nanomembranes for Biodegradable Electronics", *ACS Applied Materials & Interfaces* **11**, 18013–18023 (2019).

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Confined Synthesis for Efficient Photothermal Therapy in the Second Near-Infrared Window", *Nano Letters* **18**, 2217 (2018).

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75. **X. Sheng**#, L. Shen#, T. Kim, L. Li, X. Wang, R. Dowdy, P. Froeter, K. Shigeta, X. Li, R.G. Nuzzo, N. C. Giebink*, J. A. Rogers*, "Doubling the power output of bifacial thin-film GaAs solar cells by embedding them in luminescent waveguides", *Advanced Energy Materials* **3**, 991–996 (2013) (***Front Cover***).
76. **X. Sheng**#, C. J. Corcoran#, J. He, L. Shen, S. Kim, J. Park, R. G. Nuzzo*, J. A. Rogers*, "Enhanced ultraviolet responses in thin-film InGaP solar cells by down-shifting", *Physical Chemistry Chemical Physics* **15,** 20434–20437 (2013).
77. **X. Sheng***, J. Hu, J. Michel, L. C. Kimerling, "Light trapping limits in plasmonic solar cells: an analytical investigation", *Optics Express* **20**, A496–A501 (2012).
78. **X. Sheng***, S. G. Johnson, L. Z. Broderick, J. Michel, L. C. Kimerling, "Integrated photonic structures for light trapping in thin-film Si solar cells", *Applied Physics Letters* **100**, 111110 (2012).
79. **X. Sheng**, J. Liu, I. Kozinsky, A. M. Agawal, J. Michel*, L. C. Kimerling, "Design and non-lithographic fabrication of light trapping structures for thin film silicon solar cells", *Advanced Materials* **23**, 843–847 (2011).
80. **X. Sheng***, S. G. Johnson, J. Michel, L. C. Kimerling, "Optimization-based design of surface textures for thin-film Si solar cells", *Optics Express* **19**, A841–A850 (2011).
81. **X. Sheng***, L. Z. Broderick, J. Hu, L. Yang, A. Eshed, E. A. Fitzgerald, J. Michel, L. C. Kimerling, "Design and fabrication of high-index-contrast self-assembled texture for light extraction enhancement in LEDs", *Optics Express* **19**, A701–A709 (2011).
82. **X. Sheng***, J. Liu, N. Coronel, A. M. Agawal, J. Michel, L. C. Kimerling, "Integration of self-assembled porous alumina and distributed bragg reflector for light trapping in Si photovoltaic devices", *IEEE Photonics Technology Letters* **22**, 1394–1396 (2010).
83. X. Zhou, Z. Li, Y. Wang, **X. Sheng**, Z. Zhang*, "Photoluminescence of amorphous niobium oxide films synthesized by solid-state reaction", *Thin Solid Films* **516,** 4213–4216 (2008).
84. G. Sheng, Z. Li*, **X. Sheng**, Y. Hu, Z. Zhang, "Microcosmic behavior research of palladium membrane irradiated by helium ions", *原子能科学与技术 (Atomic Energy Science Technology)* **41**, 418 (2007) (in Chinese).
85. Y. Wang, Z. Li, **X. Sheng**, Z. Zhang*, "Synthesis and optical properties of V_2O_5 nanorods", *Journal of Chemical Physics* **126**, 164701 (2007).

Book Chapters:

1. H. Ding, **X. Sheng**, "Thin-Film III-V Single Junction and Multijunction Solar Cells and Their Integration onto Heterogeneous Substrates", in *Inorganic Flexible Optoelectronics: Materials and Applications* ed. by Z. Ma and D. Liu, Wiley-VCH (2019).
2. **X. Sheng**, S. Wang, L. Yin, "Flexible, Stretchable and Biodegradable Thin-Film Silicon Photovoltaics", in *Advances in Silicon Solar Cells* ed. by S. J. Ikhmayies, Springer-Verlag (2018).
3. L. Yin, **X. Sheng**, "Nonconventional Biosensors Based on Nanomembrane Materials", in *Nanobiomaterials: Classification, Fabrication and Biomedical Applications* ed. by X. Wang, M.

Ramalingam, X. Kong and L. Zhao, Wiley-VCH (2018).
4. **X. Sheng**, *Thin-film Silicon Solar Cells: Photonic Design, Process and Fundamentals*, LAMBERT Academic Publishing (2012).

Patents:

1. **X. Sheng**, C. Liu, Y. Zhao, L. Li, X. Cai, Y. Xie, Q. Wang, "Wireless, Multifunctional Optogenetic Systems", submitted
2. **X. Sheng**, H. Ding, Z. Shi, "Optoelectronic Upconversion Devices", CN108011017B / WO2019100380.
3. J. A. Rogers, **X. Sheng**, C. A. Bower, M. Meitl, S. Burroughs, "Printing-based multi-junction, multi-terminal photovoltaic devices", US20150207012 / WO2015109242.
4. A. Agarwal, B. Albert, L. Z. Broderick, J. Cheng, J. Hu, L. C. Kimerling, J. Liu, J. Michel, **X. Sheng**, "Methods and apparatus for concentration photovoltaics", US20140090686 / WO2013056139.
5. **X. Sheng**, J. Liu, J. Michel, A. M. Agarwal, L. C. Kimerling, "Pseudo-periodic structure for use in thin film solar cells", US20100307579 / WO2010141145.

Invited Talks

2022
- Conference on Micro-nano Optical Technology and Application (MOTA), Nanjing, China
- Conference on Applied Optics and Photonics China (AOPC), China
- Materials Research Society Fall Meeting, USA
- Workshop on Advanced Epitaxy for Freestanding Membranes and 2D Materials, USA
- International Conference on Frontier Materials, Hong Kong, China

2021
- Conference on Micro-nano Optical Technology and Application (MOTA), Guangzhou, China
- International Conference on Flexible Electronics, Hangzhou, China
- Chinese Biomaterials Congress, Shanghai, China
- International Union of Materials Research Societies – International Conference in Asia, Korea
- International Symposium of Flexible & Stretchable Electronics (ISFSE), Wuhan, China
- IEEE International Conference on Nano/Micro Engineered & Molecular Systems (IEEE-NEMS), Xiamen, China

2019
- Conference on Micro-nano Optical Technology and Application (MOTA), Nanjing, China
- Applied Optics and Photonics China (AOPC), Beijing, China
- Laser Technology and Optoelectronics (LTO) Conference, Shanghai, China

2018
- Progress in Electromagnetics Research Symposium (PIERS), Toyama, Japan
- International Symposium on the Physics of Semiconductors and Applications, Jeju, Korea
- IEEE 3M-Nano, Hangzhou, China
- Microsystems & Nanoengineering Summit (MINE), Beijing, China
- Laser Technology and Optoelectronics (LTO) Conference, Shanghai, China

- China Semiconductor Technology International Conference, Shanghai, China

2017
- Conference on Micro/Nano Optical Technology and Application, Suzhou, China
- International Conference on Advanced Fibers and Polymer Materials, Shanghai, China
- School of Electronic Information and Electrical Engineering, Shanghai Jiaotong University, China
- Suzhou Inst. Nanotech. & Nano-bionics, Chinese Academy of Sciences
- China Biomedical Engineering Conference, Beijing, China
- International Conference on Energy, Materials and Photonics, Shenzhen, China
- Wiley Small Science Symposium: Flexible and Wearable Devices, Hong Kong, China
- Laser Technology and Optoelectronics (LTO) Conference, Shanghai, China

2016
- Light, Energy and the Environment Congress, OSA meeting, Leipzig, Germany
- International Conference on Optoelectronics and Microelectronics Technology, Shanghai, China
- Leibniz Institute for Solid State and Materials Research, Dresden, Germany
- School of Electronic Science and Engineering, Nanjing University
- Institute of Microelectronics and Optoelectronics, Zhejiang University

2015
- School of Optoelectronic Information, Univ. Electronic Sci. & Tech. China
- 227th the Electrochemical Society (ECS) meeting, Chicago, IL, USA
- Dept. Electrical Engr., The Pennsylvania State University
- Nano-Electronics & Photonics Seminar, University of Illinois Urbana-Champaign
- Suzhou Inst. Nanotech. & Nano-bionics, Chinese Academy of Sciences
- University of Michigan – Shanghai Jiao Tong University Joint Institute

2014
- School of Engr. & Appl. Sci., Harvard University
- US DOE Energy Frontier Research Center – Light-Material Interactions Annual Meeting, San Francisco, CA, USA
- Dept. Electrical & Computer Engr., University of Wisconsin-Madison
- Dept. Electrical Engr., Tsinghua University

2013
- School of Materials Sci. & Eng., Huazhong Univ. Sci. & Tech.
- Wuhan National Lab of Optoelectronics
- School of Microelectronics and Solid-State Electronics, Univ. Electronic Sci. & Tech. China
- School of Materials Sci. & Engr., Tsinghua University

Services

Internal at Tsinghua:

- *Panelist in postdoc searching committee*
- *Panelist in graduate admission committee*
- *Panelist in undergraduate admission committee*

- *Panelist in graduate thesis committee*
- *Freshmen Mentor*
- *Supervising undergraduate students supported by the Student Research Training (SRT) program*

External:

- *Society Membership*
- *IEEE senior member, Optica member, SPIE life member*

- *Journal Editor*
- *Optical Materials Express*, Associate Editor, 2017–present.
- *Optical Materials Express*, Feature issue "Bio-inspired and Bio-integrated Photonic Materials and Devices", Lead Editor, 2019.
- *Frontiers in Nanotechnology*, Feature issue "New Technologies for Large-Scale Recording and Modulation in the Brain", Lead Editor, 2021.

- *Board Member*
- *Chinese Association of Automation*
- *Chinese NeuroScience Society*
- *Chinese Society of Biomedical Engineering*

- *Conference Organizer for multiple domestic and international conferences*
- 2023 Optica Advanced Photonics Congress, Solar Energy and Light-Emitting Devices (SOLET) Topical Meeting, Busan, Korea. Subcommittee.
- 2020 CIMTEC 9th Forum on New Materials, Montecatini Terme, Italy. International Advisory Board Member.
- 2019 IEEE-EMBS 16th International Conference on Wearable and Implantable Body Sensor Networks (BSN), Chicago, IL, USA. Technical Program Committee.
- 2019 MRS spring meeting, Phoenix, AZ, USA. Symposium Organizer.
- 2017 OSA IPR meeting, New Orleans, LA, USA. Subcommittee.
- 2016 MRS fall meeting, Boston, MA, USA. Symposium Organizer.
- 2016 MRS spring meeting, Phoenix, AZ, USA. Symposium Organizer.

- *Reviewer for multiple international journals*

- *Proposal Reviewer for NSFC, and multiple international funding agencies*

- *Co-president, MIT Chinese Association of Science and Technology, 2010.*

- *Scientific consultant for several high-tech start-up companies.*

Awards and Honors

International

- Young Scientist Award, PhotonIcs & Electromagnetics Research Symposium (PIERS), 2018
- Young Scientist Award, Microsystems & Nanoengineering Summit (MINE), 2018

- Best Poster Award (2nd prize) in Nature Conference on Flexible Electronics, Nanjing, 2016
- Gordon Engineering Leadership Teaching Assistantship, MIT, 2011
- Energy Initiative Seed Fund Award, MIT, 2010
- Best Poster Award (runner-up) in the 35th IEEE Photovoltaic Specialists Conference, 2010
- Energy Initiative Martin Fellowship, MIT, 2010
- DuPont-MIT Alliance Fellowship, 2007
- MIT Presidential Fellowship, 2007

Domestic (in Chinese)

- 清华大学，电子工程系，郑君里教书育人优秀教师奖，2022
- 清华大学，电子工程系，周炳琨学者奖，2022
- 中国材料研究学会，科学技术一等奖（基础研究类），生物可降解材料的性能调控及新型器件研究（编号：211-07），清华大学：尹斓，王秀梅，盛兴
- 《中国激光》主编推荐奖优秀论文，2019
- “中国新锐科技卓越影响奖”，2018
- 青年千人计划，2014
- 清华大学，优良毕业生，2007
- 清华大学，杜邦学生奖学金，2006
- 清华大学，三星学生奖学金，2005
- 清华大学，伍占德学生奖学金，2004
- 清华大学，新生奖学金，2003