XING SHENG

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Assistant 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

- ***Assistant Professor, Dept. Electronic Engineering, Tsinghua University, 2015– present***

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

Research Interests

- Non-conventional optoelectronics for biomedical applications
- Silicon, III-V and tandem thin-film solar cells and concentrators
- Photonic integrated circuits
- Inorganic (Si, Ge and III-V) thin-film photonic devices (photodetectors, LEDs, lasers, etc)
- Biocompatible and biodegradable photonics

Awards and Honors

- Best Poster Award (2nd prize) in Nature Conference on Flexible Electronics, Nanjing, 2016
- '1000 Plan Program for Young Talents', Chinese government, 2015
- 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
- Outstanding Graduates, Tsinghua University, 2007
- DuPont Scholarship, Tsinghua University, 2006
- Samsung Scholarship, Tsinghua University, 2005
- Wuzhande Scholarship, Tsinghua University, 2004
- Freshman Scholarship, Tsinghua University, 2003

Research Experience

University of Illinois at Urbana-Champaign (2012–2015)

- *US Department of Energy, Energy Frontier Research Center, Light-Material Interactions*

- High efficiency, printing based multijunction InGaP/GaAs/InGaAsNSb/Ge solar cells
- Visible-blind UV detection and imaging based on silicon and down-shifting luminophores
- Thin-film GaAs and InGaP micro solar cells and concentrators

- *US National Institute of Health, National Institute on Drug Abuse, Extramural Collaboration*

- Injectable multifunctional optoelectronic probes for neural activity monitoring and control

- *Intel Corporation*

- Transfer printed microscale thin-film III-V lasers on Si for photonic integrated circuits

Massachusetts Institute of Technology (2007–2012)

- *Robert Bosch LLC and Masdar Institute*

- Photonic crystal structures for light trapping for thin-film Si solar cells

- *MIT Energy Initiative Seed Award*

- Self-assembled nanotexture for high efficiency III-V LEDs

Tsinghua University (2005–2007)

- *National Natural Science Foundation of China*

- Performances of palladium films under He ion implantation
- Synthesis, characterization and properties of nanosize vanadium oxide films

Teaching Experience

- Leading Lecturer at Tsinghua

- 80230992 "Principles of Micro- and Nanofabrication for Electronic and Photonic Devices"
- 80231001 "Laboratory of Micro- and Nanofabrication for Electronic and Photonic Devices"

- 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. R. Fu, W. Luo, R. Nazempour, D. Tan, H. Ding, K. Zhang, L. Yin, J. Guan*, **X. Sheng***, "Implantable and Biodegradable Poly(L-lactic acid) Fibers for Optical Neural Interfaces", *Advanced Optical Materials* **XX,** 1700941 (2018).
2. L. Li, C. Liu, Y. Su, J. Bai, J. Wu, Y. Han, Y. Hou, S. Qi, Y. Zhao, H. Ding, Y. Yan, L. Yin, P. Wang, Y. Luo, **X. Sheng***, "Heterogeneous Integration of Microscale GaN Light Emitting Diodes and Their Electrical, Optical and Thermal Characteristics on Flexible Substrates", *Advanced Materials Technologies* **XX,** 1700239 (2018).

3. Z. Shi, L. Li, Y. Zhao, R. Fu, **X. Sheng***, "Implantable Optoelectronic Devices and Systems for Biomedicine: Review and Prospect", *中国激光 (Chinese Journal of Lasers)* **XX,** XXX (2018) (In Chinese) (***Invited***) (***Front Cover***).
4. Y. Yao, K. Lee, **X. Sheng**, N. A. Batara, N. Hong, J. He, L. Xu, M. M. Hussain, H. A. Atwater, N. S. Lewis, R. G. Nuzzo*, J. A. Rogers*, "Porous Nanomaterials for Ultra broadband Omnidirectional Anti-Reflection Surfaces with Applications in High Concentration Photovoltaics", *Advanced Energy Materials* **7,** 1601992 (2017) (***Frontispiece Cover***).
5. H. Araki, J. Kim, S. Zhang, A. Banks, K. E. Crawford, **X. Sheng**, P. Gutruf, Y. Shi, R. M. Pielak, J. A. Rogers*, "Materials and Device Designs for an Epidermal UV Colorimetric Dosimeter with Near Field Communication Capabilities", *Advanced Functional Materials* **27**, 1604465 (2017) (***Back Cover***).
6. K. Lee, Y. Yao, J. He, B. Fisher, **X. Sheng**, M. Lumb, L. Xu, M. A. Anderson, D. Scheiman, S. Han, Y. Kang, A. Gumus, R. Bahabry, J. W. Lee, U. Paik, N. D. Bronstein, A. P. Alivisatos, M. Meitl, S. Burroughs, M. M. Hussain, J. C. Lee*, R. Nuzzo*, J. A. Rogers*, "Concentrator Photovoltaic Module Architectures With Capabilities for Capture and Conversion of Full Global Solar Radiation", *Proceedings of the National Academy of Sciences USA*, **113,** E8210–E8218 (2016).
7. J. Kim, G. A. Salvatore*, H. Araki, A. M. Chiarelli, Z. Xie, A. Banks, **X. Sheng**, Y. Liu, J. W. Lee, K. Jang, S. Y. Heo, K. Cho, H. Luo, B. Zimmerman, J. Kim, L. Yan, X. Feng, S. Xu, M. Fabiani, G. Gratton, Y. Huang, U. Paik*, J. A. Rogers*, "Battery-free, stretchable optoelectronic systems for wireless optical characterization of the skin", *Science Advances* **8,** E1600418 (2016).
8. Y. Yao, L. Xu, **X. Sheng**, N. D. Bronstein, J. A. Rogers, A. P. Alivisatos, R. G. Nuzzo*, "Full solar spectrum conversion via multi-junction architectures and optical concentration", in *Roadmap on optical energy conversion*, *Journal of Optics* **18,** 073004 (2016) (***Invited***).
9. X. Guo*, D. Wang, B. Liu, S. Li, **X. Sheng**, "Enhanced light absorption in thin film silicon solar cells with Fourier-series based periodic nanostructures", *Optics Express* **24,** A408–A413 (2016).
10. **X. Sheng**#, C. Robert#, S. Wang, G. Pakeltis, B. Corbett*, J. A. Rogers*, "Transfer Printing of Fully Formed Thin-Film Microscale GaAs Lasers on Silicon with a Thermally Conductive Interface Material", *Laser and Photonics Reviews* **9,** L17–L22 (2015) (***Back Cover***).
11. **X. Sheng**, M. H. Yun, C. Zhang, A. M. Al-Okaily, M. Masouraki, L. Shen, S. Wang, W. L. Wilson, J. Y. Kim, P. Ferreira, X. Li, E. Yablonovitch, J. A. Rogers*, "Device architectures for enhanced photon recycling in thin-film multijunction solar cells", *Advanced Energy Materials* **5,** 1400910 (2015) (***Back Cover***).
12. J. S. Price#, **X. Sheng**#, B. Meulblok, J. A. Rogers*, N. C. Giebink*, "Wide-angle planar microtracking for quasi-static microcell concentrating photovoltaics", *Nature Communications* **6,** 6223 (2015).
13. J. S. Price, N. C. Giebink, **X. Sheng**, J. A. Rogers, "Putting CPV on rooftops", *Compound Semiconductor Magazine* **21,** 44 (2015) (***Invited***).
14. **X. Sheng**#, C. A. Bower#, S. Bonafede, J. W. Wilson, B. Fisher, M. Meitl, H. Yuen, S. Wang, L. Shen, A. R. Banks, C. J. Corcoran, R. G. Nuzzo, S. Burroughs*, J. A. Rogers*, "Printing-based assembly of quadruple junction, four-terminal microscale solar cells and their use in high-efficiency modules", *Nature Materials* **13,** 593–598 (2014).
15. **X. Sheng**#, C. Yu#, V. Malyarchuk, Y. Lee, S. Kim, T. Kim, L. Shen, C. Horng, J. Lutz, N. C. Giebink, J. Park, J. A. Rogers*, "Silicon based visible-blind ultraviolet detection and imaging using down-shifting luminophores", *Advanced Optical Materials* **2,** 313 (2014) (***Frontispiece Cover***).
16. **X. Sheng***, L. Z. Broderick, L. C. Kimerling, "Photonic crystal structures for light trapping in thin-film Si solar cells: modeling, process and optimizations", *Optics Communications* **314,** 41 (2014) (***Invited***).
17. H. Ning, N. A. Krueger, **X. Sheng**, H. Keum, C. Zhang, K. D. Choquette, X. Li, S. Kim, J. A. Rogers, P. V. Braun*, "Transfer printing of tunable porous silicon microcavities with embedded emitters",

ACS Photonics **1,** 1144–1150 (2014).

18. Y. Shen, Y. Jia, **X. Sheng**, L. Shen, J. A. Rogers, N. C. Giebink*, "Nonimaging optical gain in luminescent concentration through photonic control of emission etendue", *ACS Photonics* **1,** 746–753 (2014).
19. Y. Zou, **X. Sheng**, K. Xia, H. Fu, J. Hu*, "Parasitic loss suppression in photonic and plasmonic photovoltaic light trapping structures", *Optics Express* **22**, A1197–A1202 (2014).
20. **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***).
21. **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).
22. **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).
23. **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).
24. **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).
25. **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).
26. **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).
27. **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).
28. 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).
29. 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).
30. 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 (2018).
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. **X. Sheng**, *Thin-film Silicon Solar Cells: Photonic Design, Process and Fundamentals*, LAMBERT Academic Publishing (2012).

Patents:

1. **X. Sheng**, H. Ding, Z. Shi, "Optoelectronic Upconversion Devices", filed.
2. J. A. Rogers, **X. Sheng**, C. A. Bower, M. Meitl, S. Burroughs, "Printing-based multi-junction, multi-terminal photovoltaic devices", US20150207012 / WO2015109242.
3. 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.
4. **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

2018
- 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
- Small Science Symposium: Flexible and Wearable Devices, Hong Kong
- 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:

- *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:

- *Journal Editor*
- *Optical Materials Express*, Associate Editor, 2017–present.

- *Conference 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.

- *Journal Reviewer*
- NPG: *Scientific Reports, Flexible Electronics*
- Wiley: *Advanced Materials, Progress in Photovoltaics: Research and Applications, Energy Science and Engineering, International Journal of Numerical Modeling: Electronic Networks, Devices and Fields*
- AIP: *Applied Physics Letters, Journal of Applied Physics, AIP Advances*
- OSA: *Optics Letters, Optics Express, Optica, Journal of the Optical Society of America B, Chinese Optics Letters, Optical Materials Express, Applied Optics*
- IEEE: *IEEE Journal of Photovoltaics, IEEE Photonics Journal*
- ACS: *ACS Nano*
- Elsevier: *Optics Communications, Optical Materials, Applied Surface Science, Materials Science in Semiconductor Processing, Photonics and Nanostructures - Fundamentals and Applications, Optics and Laser Technology*
- RSC: *Journal of Materials Chemistry A, Journal of Materials Chemistry C*
- Springer: *Journal of Materials Science, Metallurgical and Materials Transactions B, Optimization and Engineering*
- SPIE: *Optical Engineering*
- others: *MRS Advances, Journal of Modern Optics, Journal of Visualized Experiments, Frontiers in Materials: Optics and Photonics*

- Co-president, MIT Chinese Association of Science and Technology, 2010.
- Scientific consultant for several high-tech start-up companies.