

XING SHENG

xingsheng@tsinghua.edu.cn

<http://oa.ee.tsinghua.edu.cn/~shengxing/>

Assistant Professor

Department of Electronic Engineering
Rohm Building 8-202, Tsinghua University
Beijing, China 100084
Tel: +86 10 6278 2515

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

- Teaching Assistant MIT course 3.003 “Principles of Engineering Practice”
- Teaching Assistant MIT course 3.024 “Electronic, Optical and Magnetic Properties of Materials”
- Teaching Assistant MIT course 3.032 “Mechanical Behavior of Materials”
- Teaching Assistant MIT course 3.034 “Organic and Biomaterials Chemistry”
- Guest Lecturer MIT course 6.152J “Microelectronics Processing Technology”
- Guest Lecturer UIUC course MSE 488 “Optical Materials”
- Supervised undergraduate and graduate students at MIT, UIUC and Tsinghua

Publications

Peer-Reviewed Journals:

#co-first author, *corresponding author

1. 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* **XX**, XXX (2017).
2. 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**).

3. 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).
4. 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).
5. 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*).
6. 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).
7. **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*).
8. **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*).
9. 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).
10. J. S. Price, N. C. Giebink, **X. Sheng**, J. A. Rogers, “Putting CPV on rooftops”, *Compound Semiconductor Magazine* **21**, 44 (2015) (*Invited*).
11. **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).
12. **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*).
13. **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 Review*).
14. 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).
15. 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).
16. 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).
17. **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*).

18. **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).
19. **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).
20. **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).
21. **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).
22. **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).
23. **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).
24. **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).
25. 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).
26. G. Sheng, Z. Li*, **X. Sheng**, Y. Hu, Z. Zhang, “Microcosmic behavior research of palladium membrane irradiated by helium ions”, *Atomic Energy Science Technology* **41**, 418 (2007) (in Chinese).
27. Y. Wang, Z. Li, **X. Sheng**, Z. Zhang*, “Synthesis and optical properties of V₂O₅ nanorods”, *Journal of Chemical Physics* **126**, 164701 (2007).

Book Chapters:

1. **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 (2016) *in press*
2. **X. Sheng**, *Thin-film Silicon Solar Cells: Photonic Design, Process and Fundamentals*, LAMBERT Academic Publishing (2012).

Conference Presentations and Proceedings:

1. **X. Sheng**, “Advanced Photon Management in Printed High-Efficiency Multijunction Solar Cells”, *OSA meeting - Light, Energy and the Environment Congress*, Leipzig, Germany (2016) (**Invited**)
2. **X. Sheng**, “Implantable multifunctional optoelectronic neural probe”, *SPIE Photonics Asia*, Beijing, China (2016).
3. **X. Sheng**, “An Implantable, Multi-Functional Neural Probe based on Printed Microscale Optoelectronic Devices”, *International Symposium on Photonics and Optoelectronics*, Xi’an, China (2016).
4. **X. Sheng**, “Implantable Multifunctional Optoelectronic Neural Probe”, *Nature Conference on Flexible Electronics — Challenges and Opportunities*, Nanjing, China (2016). (**Poster Award**)
5. **X. Sheng**, “Transfer Printing of Thin-Film Microscale GaAs Lasers on Silicon”, *International Symposium on Optoelectronic Technology and Application*, Beijing, China (2016).
6. **X. Sheng**, C. Robert, B. Corbett, J. A. Rogers, “Transfer Printing of Thin-Film Microscale GaAs Lasers on Silicon with a Thermally Conductive Interface”, *MRS Spring Meeting*, Phoenix, AZ, USA

(2016).

7. **X. Sheng**, J. A. Rogers, “Advanced Photon Management in Printed High-Efficiency Multijunction Solar Cells”, *227th ECS Meeting*, Chicago, IL, USA (2015). (**Invited**)
8. G. Pakeltis, **X. Sheng**, C. Robert, S. Wang, B. Corbett, J. A. Rogers, “Integration of Thin-Film Microscale III-V Lasers onto Silicon”, *SRC TECHCON Conference*, Austin, TX, USA (2015).
9. M. P. Lumb, K. J. Schmieder, M. Gonzalez, S. Mack, M. K. Yakes, M. Meitl, S. Burroughs, C. Ebert, M. F. Bennett, D. V. Forbes, **X. Sheng**, J. A. Rogers, R. J. Walters, “Realizing the next generation of CPV cells using transfer printing”, *11th International Conference on Concentrator Photovoltaic Systems*, France (2015).
10. **X. Sheng**, C. 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, “Printed High-Efficiency Quadruple-Junction, Four-Terminal Solar Cells and Modules for Full Spectrum Utilization”, *IEEE Photonics Conference*, San Diego, CA (2014).
11. **X. Sheng**, C. 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, “High Efficiency Quadruple Junction, Four-Terminal Solar Cells and Modules by Transfer Printing”, *40th IEEE Photovoltaic Specialists Conference*, Denver, CO, USA (2014).
12. **X. Sheng**, L. Shen, T. Kim, L. Li, R. Dowdy, X. Li, R. G. Nuzzo, N. C. Giebink, J. A. Rogers, “Thin-Film GaAs Micro Solar Cells on Luminescent Substrates for Enhanced Power Output”, *MRS Fall Meeting*, Boston, MA, USA (2013).
13. J. S. Price, **X. Sheng**, J. A. Rogers, N. C. Giebink, “Wide-Angle Planar Microtracking for High Efficiency Microcell Concentrating Photovoltaics”, *OSA Meeting-Optics for Solar Energy*, Tucson, AZ, USA (2013).
14. L. Li, **X. Sheng**, J. A. Rogers, R. G. Nuzzo, “Numerical Modeling of Fluorescence Emission Energy Dispersion in Luminescent Solar Concentrator”, *APS March Meeting*, Baltimore, MD, USA (2013).
15. L. Li, **X. Sheng**, E. P. Brueckner, Y. Yao, J. A. Rogers, R. G. Nuzzo, “Modeling and Optimization of Luminescent Solar Concentrator for Micro Cell Array Module”, *Frontiers in Optics (OSA 96th Annual Meeting)*, Rochester, NY, USA (2012). (**Post-deadline**)
16. **X. Sheng**, L. Z. Broderick, J. Liu, S. G. Johnson, J. Michel, L. C. Kimerling, “Explore Light Trapping for Thin-Film Silicon Solar Cells—Design and Fabrication”, *MRS Fall Meeting*, Boston, MA, USA (2011).
17. L. Z. Broderick, M. Stefancich, D. Roncati, B. R. Albert, **X. Sheng**, L. C. Kimerling, J. Michel, “Solar Spectrum Splitting Parallel Multijunction High Efficiency Concentrating Photovoltaics”, *MRS Fall Meeting*, Boston, MA, USA (2011).
18. P. Bermel, M. Ghebrebrhan, C. Lau, **X. Sheng**, J. Michel, L. C. Kimerling, M. Soljacic, S. G. Johnson, “Correlated Randomness for Broad-Band Light-Trapping in Semiconductor Systems”, *MRS Fall Meeting*, Boston, MA, USA (2011).
19. **X. Sheng**, S. G. Johnson, J. Michel, L. C. Kimerling, “Optimization-based Design of Surface Textures for Thin-Film Si Solar Cells—Are Lambertian Models Relevant”, *37th IEEE Photovoltaic Specialists Conference*, Seattle, WA, USA (2011).
20. **X. Sheng**, J. Liu, I. Kozinsky, J. Michel, A. M. Agarwal, L. C. Kimerling, “Efficient Light Trapping Structure in Thin Film Silicon Solar Cells”, *35th IEEE Photovoltaic Specialists Conference*, Honolulu, HI, USA (2010). (**Best Poster Award**)
21. **X. Sheng**, J. Liu, I. Kozinsky, A. M. Agarwal, J. Michel, L. C. Kimerling, “Efficiency Enhancement by Light Trapping in Thin Film Silicon Solar Cells”, *MRS Spring Meeting*, San Francisco, CA, USA (2010).
22. **X. Sheng**, J. Liu, J. Michel, A. M. Agarwal, L. C. Kimerling, “Low-cost, deterministic quasi-periodic photonic structures for light trapping in thin film silicon solar cells”, *34th IEEE Photovoltaic*

Patents:

1. J. A. Rogers, **X. Sheng**, C. A. Bower, M. Meitl, S. Burroughs, “Printing-based assembly of multi-junction, multi-terminal photovoltaic devices and related methods”, US20150207012 / WO2015109242.
2. 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.
3. **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

2017

- 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
- 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
- UA 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. & Engr., 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:

- *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, 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*
 - 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.