

Sunmi SHIN, Ph.D.

National University of Singapore
9 Engineering Drive 1, E2-03-12, Singapore 117575
Tel: +65 6516 6350
E-mail: mpeshin@nus.edu.sg
ORCID: 0000-0001-8448-2622
Nationality: South Korea

<http://sites.google.com/view/heatlabatnus>

Research Interests

nanoscale heat transfer (thermal radiation and conduction); plasmonics; infrared optics; solar-thermal energy; thermoelectric devices;

Professional Appointments

Assistant Professor National University of Singapore Department of Mechanical Engineering	08.2020 – 06.2026
Research Assistant Professor National University of Singapore Department of Mechanical Engineering	08.2019 – 07.2020
Research and Teaching Assistant University of California, San Diego Materials Science and Engineering Program Department of Mechanical and Aerospace Engineering	09.2014 – 06.2019

Education

Ph.D. in Materials Science and Engineering , UC San Diego Thesis: Active Thermal Engineering using Nanostructures Advisor: Renkun Chen	06.2019
M.S. in Chemical Engineering , Hanyang Univ. Thesis: Device hybridization between photovoltaic and thermoelectric (supplemented with the study on a Si wire solar cell) Advisor: Jung-Ho Lee	02.2014
B.S. Major in Chemical Engineering , Hanyang Univ. Minor in Materials Science and Engineering , Hanyang Univ. Summa cum laude One-semester early graduation	08.2011

Awards and Honors

- Selected Participant, Asian Deans' Forum 2018 – The Rising Stars Women in Engineering 2018
- Powell Fellowship, UC San Diego 2014
- Best Poster Award, International Nanophotonics and Nanoenergy Conference 2014
- Brain Korea 21 Scholarship, NSF of Korea 2011
- Academic Excellence Award, Hanyang University 2011
- Academic Scholarships, Hanyang University 2008-2011

Research Grants

NUS Start-up Grant, Sole PI 11.2019 – 10.2023
Thermal Transport Measurement of Nanostructures Using Suspended Micro-Devices

Industry-Related Research Projects

- *Adaptive Textile Technology with Adaptive Cooling and Heating* 2014 – 2018
Funded by ARPA-E, USA
- *Wearable Thermoelectric Devices* 2014 – 2017
Funded by Samsung, South Korea
- *High-Temperature Stable Solar Thermal Absorbers* 2014 – 2019
Funded by Department of Energy, USA
- *Unified Solar Thermal Conversion Devices* 2011 – 2014
Funded by MOE and NRF, South Korea

Patents Filed

- [1] R. Chen, J. Wang, **S. Shin**, R. Kumar and J. Roh, *High-Performance Screen-Printed Thermoelectric Films on Fabrics*, US Patent, 16048686 (2019)
- [2] J.-H. Lee, **S. Shin**, J.-Y. Jung and M.-J. Park, *Hybrid type device for generating electricity*, PCT/KR2014/010050 (2014)
- [3] J.-H. Lee, J.-Y. Jung, **S. Shin**, Y.-H. Nam, H.-D. Um, K.-T. Park and S.-W. Jee, *Solar cell and method for manufacturing the same*, Korea Patent, 10-2011-0060801 (2011)

Publications (* implies equal contribution)

Book Chapters:

- [1] M. Zebarjadi, G. Chen, Z. Ren, **S. Shin**, R. Chen, J. P. Heremans, B. Wiendlocha, H. Jin, B. Wang, and Q. Zhang, "Engineering of Materials", Book Chapter in 'Advanced Thermoelectrics: Materials, Contacts, Devices, and Systems', Taylor & Francis (2018)

Journals:

- [1] **S. Shin** and R. Chen, “*Plasmonically Enhanced Thermal Radiation by Surface Phonon Polaritons*” (**Under Review**)
- [2] R. Hu, **S. Shin**, Y. Liu, S. Huang, X. Ren, W. Shu, J. Cheng, G. Tao, W. Xu, R. Chen, X. Luo, “*Emerging Materials and Strategies for Personal Thermal Management*”, Adv. Energy Mater. (**Under Review**)
- [3] S. S. Hong, **S. Shin**, and R. Chen, “*Adaptive and Wearable Thermal Camouflage Device*”, Adv. Func. Mater. (**Accepted**)
- [4] R. Shrestha,* Y. Luan,* **S. Shin**, T. Zhang, W. Gong, M. Bockstaller, T. Luo, R. Chen, K. Hippalgaonkar, and S. Shen, “*High-Contrast and Reversible Polymer Thermal Regulator by Structural Phase Transition*”, Science Advances, 5:eaax3777 (2019)
- [5] **S. Shin**,* Q. Wang,* J. Luo, and R. Chen, “*Advanced Materials for High-Temperature Thermal Transport*”, Adv. Func. Mater., 1904815 (2019) - **Invited Review**
- [6] **S. Shin**, M. Elzouka, R. Prasher, and R. Chen, “*Far-Field Coherent Thermal Emission from Polaritonic Resonance in Individual Anisotropic Nanoribbons*”, Nature Communications, 10:1377 (2019)
- [7] E. B. Rubin, **S. Shin**, Y. Chen, and R. Chen, “*High-temperature Stable Refractory Nanoneedles with over 99% Solar Absorptance*”, APL Materials, 7, 031101 (2019) – **selected as an Editor’s Pick**
- [8] **S. Shin**, S. Hong, and R. Chen, “*Hollow Photonic Structures of Transparent Conducting Oxide with Selective and Tunable Absorptance*”, Applied Thermal Engineering, 145, 416 (2018)
- [9] **S. Shin**, J. W. Roh, H.-S. Kim, and R. Chen, “*Role of Surfactant on Thermoelectric Behaviors of Organic-Inorganic Composites*”, J. Appl. Phys., 123, 205106 (2018)
- [10] **S. Shin**, R. Kumar, J. W. Roh, D.-S. Ko, H.-S. Kim, S. I. Kim, L. Yin, S. M. Schlossberg, S. Cui, J.-M. You, S. Kwon, J. Zheng, J. Wang, and R. Chen, “*High-Performance Screen-Printed Thermoelectric Films on Fabrics*”, Sci. Rep., 7, 7317 (2017) – **selected in the Top 100 Scientific Reports Physics papers in 2017.**
- [11] T. K. Kim, B. VanSaders, E. Caldwell, **S. Shin**, Z. Liu, S. Jin, and R. Chen, “*Copper-alloyed spinel black oxides and tandem-structured solar absorbing layers for high-temperature concentrating solar power systems*”, Solar Energy, 132, 257 (2016)
- [12] M.-J. Park, J.-Y. Jung, **S.-M. Shin**, J.-W. Song, Y.-H. Nam, D.-H. Kim, and J.-H. Lee, “*Photoelectrochemical oxygen evolution improved by a thin Al₂O₃ interlayer in a NiO_x/n-Si photoanode*”, Thin Solid Films, 599, 54 (2016)
- [13] J.-W. Song, Y.-H. Nam, M.-J. Park, **S.-M. Shin**, R. B. Wehrspohn and J.-H. Lee, “*Hydroxyl functionalization improves the surface passivation of nanostructured silicon solar cells degraded by epitaxial regrowth*”, RSC. Adv., 5(49), 39177 (2015)
- [14] **S.-M. Shin**,* J.-Y. Jung,* M.-J. Park, J.-W. Song and J.-H. Lee, “*Catalyst-free hydrogen evolution of Si photocathode by thermovoltage-driven solar water splitting*”, J. Power Sources, 279, 151-156 (2015)
- [15] J.-W. Song, J.-Y. Jung, H.-D. Um, X. Li, M.-J. Park, Y.-H. Nam, **S.-M. Shin**, T.-J. Park, R. B. Wehrspohn and J.-H. Lee, “*Degradation mechanism of Al₂O₃ passivation in nanostructured Si solar cells*”, Adv. Mater. Interfaces, 15, 1400010 (2014)
- [16] K.-T. Park,* **S.-M. Shin**,* A. S. Tazebay, H.-D. Um, J.-Y. Jung, S.-W. Jee, M.-W. Oh, S.-D. Partk, B. Yoo, C. Yu and J.-H. Lee, “*Lossless hybridization between photovoltaic and thermoelectric devices*”, Sci. Rep., 3, 1-6 (2013)
- [17] **S.-M. Shin**, J.-Y. Jung, K.-T. Park, H.-D. Um, S.-W. Jee, Y.-H. Nam and J.-H. Lee, “*A novel wrap-around metal contact optimized for radial p-n junction Si wire solar cells*”, Energy & Environ. Sci., 6 (6), 1756-1760 (2013)

- [18] Y.-H. Nam, H.-D. Um, K.-T. Park, **S.-M. Shin**, J.-W. Baek, M.-J. Park, J.-Y. Jung, K. Zhou, S.-W. Jee, Z. Guo and J.-H. Lee, “*Multi-layer Coating of SiO₂ Nanoparticles to Enhance Light Absorption by Si Solar Cells*”, J. Kor. Phy. Soc., 60, 1944-1948 (2012)