Kedar Hippalgaonkar

Scientist, Institute of Materials Research and Engineering
Agency for Science, Technology and Research
Adjunct Assistant Professor, Materials Science and Engineering
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Research Interests

Utilizing my multi-disciplinary background in Mechanical Engineering, Materials Science and Physics to tackle problems in solid-state materials, especially in nanoscale transport of phonons, electrons and photons.

Expertise

Measurement of Thermal and Thermoelectric Properties of Nanomaterials (1D, 2D and inorganic-organic hybrid materials), Transmission Electron Microscopy, Structure-Property studies in nanoscale Condensed Matter

Education

University of California at Berkeley, CA — Aug 2007 – Aug 2013
Department of Mechanical Engineering (GPA: 3.9)

PhD Advisors: **Prof. Arun Majumdar** (2007-2009)
Prof. Xiang Zhang (2012-2013)
Thesis: Using morphology and structure to tune solid-state thermal properties

Purdue University, West Lafayette, IN — Jan 2003 – Dec 2005
Department of Mechanical Engineering (GPA: 3.92)

Bachelor of Science in Mechanical Engineering (Distinction)
Research Advisor: **Prof. Arvind Raman**
Undergraduate Research Thesis: Use of Wavelet Transforms to study Tip Sample Interactions in Tapping Mode Atomic Force Microscopy

Awards

Graduate Student **Silver** Award — April 2013
Materials Research Society

Nominated to represent UC Berkeley — Jan 2013
-Global Youth Scientist Summit
National Research Foundation, Singapore

Graduate Fellowship — Aug 2007 – Aug 2012

National Science Scholarships
Agency for Science Technology and Research, Singapore

Summer Undergraduate Research Fellowship — May 2005 – Sep 2005
Purdue University

Kaiser Scholarship for Outstanding Academic Performance — 2005
Purdue University

Zmola Undergraduate Teaching Fellowship — 2005
Purdue University

Top 10 Outstanding Mechanical Engineering Portfolios — 2004
Purdue University

Work Experience

Research Associate — Jan 2013-Dec 2013
Prof. Xiang Zhang Group, UC Berkeley

Scientific Consulting — Aug 2011 – Mar 2012
Alphabet Energy, Inc.
Identified key technology areas and directions for Thermoelectric Applications

Research Internship — Jan 2006 – Apr 2007
Institute of Materials Research and Engineering, Singapore
Research Topic: Ultra High Vacuum Scanning Thermovoltage Microscopy

Research Internship — Apr 2004 – Oct 2004
Singapore Institute of Manufacturing Technology, Singapore
Research Topic: Micro-XRD on Ball-Milled TiO_2 nanospheres

Journal Publications

"Anomalously low electronic thermal conductivity in metallic vanadium dioxide", Sangwook Lee*, **Kedar Hippalgaonkar***, Fan Yang*, Jiawang Hong*, Changhyun Ko, Joonki Suh, Kai Liu, Kevin Wang, Jeffrey J. Urban, Xiang Zhang, Chris Dames, Sean A. Hartnoll, Olivier Delaire, Junqiao Wu, *under review*, **Science** (2016)

"High Thermoelectric Powerfactor in 2D Crystals of MoS_2", **Kedar Hippalgaonkar***, Ying Wang*, Yu Ye*, Hanyu Zhu, Yuan Wang, Joel Moore, Xiang Zhang, *under review*, **Nature Communications** (2016)

"Multifunctional 0D–2D Ni_2P Nanocrystals–Black Phosphorus Heterostructure", Zhong-Zhen Luo, Yu Zhang, Chaohua Zhang, Hui Teng Tan, Zhong Li, Anas Abutaha, Xing-

Long Wu, Qihua Xiong, Khiam Aik Khor, **Kedar Hippalgaonkar**,Jianwei Xu, Huey Hoon Hng, Qingyu Yan, *accepted*, **Advanced Energy Materials** (2016)

"Anisotropic in-plane thermal conductivity of black phosphorus nanoribbons at temperatures higher than 100K", Sangwook Lee, Fan Yang, Joonki Suh, Sijie Yang, Yeonbae Lee, Hwan Sung Choe, Aslihan Suslu, Yabin Chen, Changhyun Ko, Joonsuk Park, Kai Liu, Jingbo Li, **Kedar Hippalgaonkar**, Sefaattin Tongay, Jeffrey Urban, Junqiao Wu, **Nature Communications,** 6, 8573 (2015)

"Tunable Thermal Transport in Polysilsesquioxane (PSQ) Hybrid", Pengfei Li, Sui Yang, Teng Zhang, Ramesh Shrestha, **Kedar Hippalgaonkar#**, Tengfei Luo, Xiang Zhang, Sheng Shen, **Scientific Reports,** 6, 21452 (2016)

"Second-Harmonic Generation from Sub-5-nm Gaps by Directed Self-Assembly of Nanoparticles onto Template-Stripped Gold Substrates", Dong, Zhaogang; Asbahi, Mohamed; Lin, Jian; Zhu, Di; Wang, Ying Min; **Hippalgaonkar, Kedar**; Chu, Hong-Son; Goh, Wei Peng; Wang, Fuke; Huang, Zhiwei; Yang, Joel, **Nano Letters** 15 (9), 5976–5981 (2015)

"Temperature Gated Thermal Rectifier for Active Heat Flow Control", Jia Zhu*, **Kedar Hippalgaonkar***, Sheng Shen, Yohannes Abate, Kevin Wang, Sangwook Lee, Xiaobo Yin, Junqiao Wu, Arun Majumdar, Xiang Zhang, **Nano letters** 14 (8), 4867-4872 (2014)

"Axially Engineered Metal-Insulator Phase Transition by Graded Doping VO_2 Nanowires", Sangwook Lee; Chun Cheng; Hua Guo; **Kedar Hippalgaonkar**; Kevin Wang; Joonki Suh, Kai Liu, Junqiao Wu, **JACS**, 135(12), 4850, (2013)

"Quantifying Surface Roughness Effects on Phonon Transport in Silicon Nanowires", Jong Woo Lim*, **Kedar Hippalgaonkar***, Sean Andrews, Arun Majumdar, Peidong Yang, **Nano Letters**, 12(5), 2475, (2012)

"Large Thermoelectric Figure-of-Merits from SiGe Nanowires by Simultaneously Measuring Electrical and Thermal Transport Properties", Eun Kyung Lee, Liang Yin, Seung Nam Cha, Dongmok Whang, Gyeong S. Hwang, **Kedar Hippalgaonkar**, Arun Majumdar, Choongho Yu, Byoung Lyong Choi, Jong Min Kim, Kinam Kim, **Nano Letters**, 12(6), 2918, (2012)

"Observation of Anisotropy in Thermal Conductivity of Individual Single-crystalline Bi Nanowires", Jong Wook Roh*, **Kedar Hippalgaonkar***, Jin hee Ham, Renkun Chen, Ming Zhi Li, Peter Ercius, Woochul Kim, Arun Majumdar, Wooyoung Lee, **ACS Nano** 5, 3954 (2011)

"Fabrication of microdevices with integrated nanowires for investigating low-dimensional phonon transport"; **Kedar Hippalgaonkar***, Baoling Huang*, Renkun Chen*, Karma Sawyer, Arun Majumdar, **Nano Letters**, 10(11), 4341, (2010)

"Room temperature observation of point defect on gold surface using thermovoltage mapping"; Arijit Roy, Cher Ming Tan, Sean J. O'Shea, **Kedar Hippalgaonkar** and Wulf

Hofbauer, **Microelectronics Reliability**, **47**, 1580 (2007)
**denotes equal contribution, #denotes corresponding author*

Active Competitive Grants

- Collaborator: Public Sector Funding, A-Star: "Thermal and Electrical Transport in nanostructured TiO_2" with Prof. Liu Bin (NTU) and Prof. John Thong (NUS), ~S$900k, 3 years, awarded April 2015
- **Program Manager** Pharos, A-Star: "Hybrid Thermoelectric Materials for Ambient Applications" >S$12 million, 5 years, commenced 1 Jan 2016
    - Lead-PI for individual project under this program: ~S$2.3 million, 5 years
- Co-PI: Pharos, A-Star: "Phononics & Thermoelectrics with 2D Materials", ~S$1.2 million, 5 years, commenced 1 Jan 2016

Conferences and Invited Seminars

"Thermal and Thermoelectric Transport in inorganic-organic hybrid materials", **Kedar Hippalgaonkar**, Materials Research Society (MRS) Fall Meeting, Boston (***Invited Talk** 2016)*

"Thermoelectric Powerfactor and Interface Thermal Resistance in 2D MoS_2", **Kedar Hippalgaonkar**, Center for Advanced 2D Materials (CA2DM) and Physics Department Seminar, NUS (***Invited Talk** 2015*)

"High Thermoelectric Powerfactor in Single and Few-Layer MoS_2"; **Kedar Hippalgaonkar**, Materials Research Society (MRS) Spring Meeting, San Francisco (2015)

"Ultralow thermal conductivity in Mesoporous Silicon Nanowires"; **Kedar Hippalgaonkar**, Materials Research Society (MRS) Spring Meeting, San Francisco (2015)

"Temperature Gated Solid-State Thermal Rectifier"; **Kedar Hippalgaonkar**, Physics Department Seminar, California State University, Long Beach (***Invited Talk*** 2013)

"Using Morphology and Structure to Tune Solid-state Thermal Properties"; **Kedar Hippalgaonkar**, Jongwoo Lim, Peter Ercius, Jia Zhu, Renkun Chen, Xiang Zhang, Peidong Yang, Arun Majumdar, Materials Research Society (MRS) Spring Meeting, San Francisco – (***Graduate Student Award Symposium*** 2013)

"Structure-Thermal Property Relations using Novel Microfabricated Platforms"; **Kedar Hippalgaonkar**, Jongwoo Lim, Jia Zhu, Peter Ercius, Peidong Yang, Arun Majumdar, American Society of Mechanical Engineers (ASME) International Mechanical Engineering Congress and Exposition (IMECE), Texas – (***Invited Talk*** 2012)

"Effect of Morphology on Thermal Conductivity of Silicon Nanowires"; **Kedar Hippalgaonkar**, Jongwoo Lim, Peter Ercius, Peidong Yang, Arun Majumdar, PHONONS 2012, Michigan – (Presentation 2012)

"Effect of Morphology and Roughness on Thermal Conductivity of Silicon Nanowires"; **Kedar Hippalgaonkar**, Jongwoo Lim, Peter Ercius, Ming Zhi Li, Renkun Chen, Peidong Yang, Arun Majumdar, 3rd Micro and Nano Heat and Mass Transfer Conference (MNHMT), Atlanta – (Presentation 2012)

"Morphology and Thermal Conductivity in Silicon Nanowires"; **Kedar Hippalgaonkar**, Jongwoo Lim, Ming Zhi Li, Peter Ercius, Renkun Chen, Peidong Yang and Arun Majumdar, Materials Research Society, Boston – (Presentation 2011)

"Phonon Transport in Silicon Nanowires for Thermoelectric Applications"; Renkun Chen, **Kedar Hippalgaonkar**, Baoling Huang, Karma Sawyer, Jinyao Tang, Peidong Yang, Arun Majumdar, Materials Research Society, San Francisco (***Invited Talk*** 2011)

"Quantifying the Effect of Surface Roughness on Phonon Transport in Silicon Nanowires"; Jongwoo Lim, **Kedar Hippalgaonkar**, Arun Majumdar, Peidong Yang, San Francisco – (Presentation 2011)

"Correlated Phonon Scattering in Mesoscopic Silicon Nanowires"; **Kedar Hippalgaonkar**, Renkun Chen, Arun Majumdar, Frontiers in Matter Waves and Optics (FOMO), Obergurgl, Austria – (Poster 2011)

"Ultra-low thermal conductivity in quasi-one dimensional Silicon Nanowires"; **Kedar Hippalgaonkar**, Jinyao Tang, Peter Ercius, Karma Sawyer, Baoling Huang, Renkun Chen, Peidong Yang, Arun Majumdar, International Heat Transfer Conference (IHTC), Washington DC – (Accepted for Proceedings 2010)

"Phonon Transport in one-dimensional Silicon Nanowires"; **Kedar Hippalgaonkar**, Jinyao Tang, Renkun Chen, Peidong Yang, Arun Majumdar, American Physical Society, Oregon – (Presentation 2010)

"Ultralow thermal conductivity in Electrolessly Etched Silicon Nanowires"; **Kedar Hippalgaonkar**, Renkun Chen, Bair Budaev, Jinyao Tang, Sean Andrews, Padraig Murphy, Subroto Mukherjee, Joel Moore, Peidong Yang, Arun Majumdar, American Physical Society, Pittsburgh – (Presentation 2009)

"Investigating Phonon Transport using Microdevices with Integrated Silicon Nanowires", Karma Sawyer, Renkun Chen, Baoling Huang, **Kedar Hippalgaonkar**, Ming Chang Lu, Materials Research Society, Boston – (Presentation 2009)

Professional Activities

- **Symposium Organizer**, Symposium NM2—Nanoscale heat transport: from fundamentals to devices, Materials Research Society, Fall Meeting, April 2017, Phoenix

- **Session Chair,** Symposium M10, Materials Research Society, Spring Meeting, April 2015, San Francisco

- **Session Chair**, Materials for Thermal Management and Thermoelectrics, Molecular Materials Meeting (M3), August 2015, Singapore

- **Session Chair**, Symposium V2, Materials Research Society, Spring Meeting, April 2013, San Francisco

- Reviewer for *Physical Review Letters, Physical Review B, Nature Nanotechnology, Nature Communications, Scientific Reports, Applied Physics Letters, International Journal of Heat and Mass Transfer, Macromolecules, Journal of Electronic Materials*

- Member of American Society of Mechanical Engineers, American Physical Society, Materials Research Society

Teaching

MSE 7059 – Nanoscale Heat and Energy Transfer
Fall 2015/2016, Graduate Level Course offered in the Materials Science and Engineering Department at NTU