Raisul Islam

Assistant Professor
School of Materials Engineering
Elmore Family School of
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Purdue University

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EDUCATION

Doctor of Philosophy, Electrical Engineering — September 2017
Stanford University, Stanford, CA — Advisor - **Prof. Krishna Saraswat**
THESIS - ***Metal Oxide Carrier Selective Contacts for On-chip Embedded Photovoltaics***
Master of Science, Electrical and Electronic Engineering
Bangladesh University of Engineering and Technology, Dhaka, Bangladesh — August 2011
Bachelor of Science (summa cum laude), Electrical and Electronic Engineering
Bangladesh University of Engineering and Technology, Dhaka, Bangladesh — July 2009

FUNDED PROJECTS

- **Nuclear Regulatory Commission (NRC) Faculty Development Grant:** Role - Co-PI, Title - "Faculty Advancement in Radiation Sensing, Detecting, and Responsive Materials", *Award to Co-PI: $292,780.*
- **National Science Foundation (NSF) Standard Grant:** Role - PI, Title - "Collaborative Research: Memtransistor with Enhanced Functionality Enables Energy-efficient AI Hardware", *Award (#2521468) to PI: $374,060.*
- **Northwest-AI-Hub in-Kind Support:** Role - Participant, Project - CXR pilot Run (to establish CXR (C: CMOS, X: Emerging Technology, R: Service Route) business unit for the Microelectronics Commons funded by DoD to facilitate lab-to-fab for CMOS+X; "X": RF/MS, FeFET, FeRAM, CNFET, RRAM/MRAM, gain cell memory, NEMS/MEMS, photonics, etc. (Equivalent amount: $85,500)
- **Applied Materials Inc. in-Kind Support:** Role - PI, Project - Utilizing Ginestra^{TM} modeling software license for collaborative research project with Applied Materials. (Estimated value: $100,000)

WORK EXPERIENCE

Assistant Professor
School of Materials Engineering — Jan. 2024 – present
Purdue University — West Lafayette, IN, USA

- Raisul Islam Semiconductor Engineering (RISE) lab works at the intersection of Materials Science and Electrical Engineering to solve materials and device challenges for making intelligent computing ubiquitous through heterogeneous integration.
- Research Group: Heng-Ray Chuang (PhD, 2024 - present), Ram Munde (PhD, 2024 – present), Yifan Wang (PhD, 2024 – present), Noah Vaillancourt (MS, 2025 – present), Congke Gu (MS, 2025 - present), Nathan Clark (Undergrad), Meera Srinivas (Undergrad)

Device Technologist — May 2022 – Jul. 2023
SunRise Memory Corporation — San Jose, CA, USA

- A start-up in series C stage working to develop new device technology leading to high-speed large-scale memory solutions for clouds and high performance computing.
- As a device technologist, my work involves guiding the R&D in emerging memory technology to meet the product specifications.

Scientific Manager/Sr. Scientist
Office of the CTO — Jul. 2020 – Apr. 2022
EMD Electronics, a business of Merck KGaA, Darmstadt, Germany — San Jose, CA, USA

- Led the research effort into materials innovation for emerging memory technologies
- Supported the research in atomic layer deposition of layered transition metal dichalcogenide materials for transistor application
- Customer driven research and internal development

Principal Engineer
Corporate Research — Aug. 2019 – Mar. 2020
TSMC Technology Inc. — San Jose, CA, USA

- Research on phase change resistive memory technology for AI hardware application
- Physics based modeling and electro-thermal simulation to optimize the cell structure for multi-bit cell operation

Post-doctoral Scholar — Advisor – *Prof. H.-S. Philip Wong*
Electrical Engineering — October 2017 – August 2019
Stanford University — Stanford, CA, USA

- Thermally enhanced resistive memory devices for multi-bit memory cell application.
- Thermoelectric enhancement of phase change memory
- Super-lattice phase change memory on flexible substrate capable of ultra-low switching energy
- Photovoltaic cell using ultra-thin layered transition metal dichalcogenide semiconductors to enable energy harvesting for flexible electronics

TEACHING EXPERIENCE

Purdue University, West Lafayette, IN
Assistant Professor — Jan. 2024 - present
Courses taught:

- MSE 270 - Atomistic Materials Science (Fall 2024)
- MSE 390 - Materials Engineering Seminar (Spring 2025)

Stanford University, Stanford, CA
Lecturer — Spring 2019, Spring 2020

- Co-taught the class EE 237 (Solar Energy Conversion).
- Developed problem sets, exam questions, course study materials.
- Provided consultation and mentorship to students.

Stanford University, Stanford, CA
Teaching Assistant — Spring 2013

- Worked as a course assistant in EE 237 (Solar Energy Conversion), helped developing course contents.
- Developed problem sets, exam questions.
- Provided consultation and mentorship to students.

Bangladesh University of Engineering and Technology, Dhaka, Bangladesh
Lecturer — 2009 – 2011

- Instructed undergraduate level courses – *microprocessor and interfacing*, *electrical properties of materials*, *fundamentals of electrical circuits*
- Developed problem sets, exam questions, conducted lab sessions.
- Provided consultation and mentorship to students in their final projects.

ENTREPRENEURIAL EXPERIENCE

Co-founder — Jan. 2025 – present
Atomos 3D Inc. — West Lafayette, IN, USA

- Co-founded a start-up with two Purdue graduates on commercializing 3D gain cell memory
- Recommended for funding in the SBIR phase - I program by National Science foundation ($305,000 in non-dilutive funding for 1-year).

Advisor Jun. 2023 – present
Arinna Inc. Palo Alto, CA, USA

- A pre-seed stage start-up working on ultra-lightweight, flexible solar cell for space application.
- Advisor to the start-up formed by commercializing the IP generated from my PhD research.

Chief Scientific Officer Jun. 2017 – Aug. 2019
Nimbus Engineering Inc. San Francisco, CA, USA

- A start-up working on wireless energy transfer technology by transferring energy optically between sender and receiver.
- Raised seed investment (>$1M)
- R&D prototyping through external suppliers.

Advisor Oct. 2017 – Feb. 2019
MDLSoft Inc. Santa Clara, CA

- Initiated and contributed to the formation of an offshore research team in Bangladesh.
- Worked on testing the software for experimental data validation.
- Acquired by Applied Materials Inc. on February 2019.

AWARDS, SCHOLARSHIPS & HONORS

- **Senior Member**, Institute of Electrical & Electronics Engineers (IEEE), 2025.
- Eric and Illeana Benhamou **Stanford Graduate Fellowship**, 2014 – 2016.
- Seed Grant Competition, **TomKat Center for Sustainable Energy**, Stanford University, 2013. Award News – http://stanford.io/2C08MpW
- Stanford Electrical Engineering Departmental Fellowship, 2011 – 2012.
- **University Gold Medal** – for graduating as *summa cum laude*, 2009.
- Member of the **Outstanding Undergraduate Education Impact Award** winning team, International Future Energy Challenge, USA, 2007.
- Member of the **IEEE Enterprise Award** winning team, 2006.

OUTREACH ACTIVITIES & SERVICE

Young Professional Forum **Device Research Conference**
Member 2025

- YPF members work with the technical program committee of the conference to help organizing the conference by organizing the Short Courses, Focus Session.
- Serve as session chair in the conference.

Electronic Materials Committee **IEEE Electron Devices Society**
Member 2024

- The committee works on publishing new focus issues for EDS journals and organize special focus session in IEEE EDS organized conferences focused on the future direction of electronic materials.

Office of Science **Department of Energy, USA**
Proposal Panel Reviewer 2024

- Reviewed project proposals for the newly formed Microelectronics Scinece Research Center.

Electrical Engineering Department **Stanford University**
Graduate Application Reviewer 2017 – 2018

- Evaluated the applications from the prospective MS and PhD applicants for initial screening.

Graduate Students in Electrical Engineering (GSEE) **Stanford University**
Founding Secretary 2011 – 2013

- Student group strengthening the communication of graduate students with faculty and administration.

PUBLICATIONS

Google Scholar: https://scholar.google.com/citations?user=qMzKt50AAAAJ&hl=en

Peer-reviewed Journals

16. **R. Islam**, S. Qin, S. Deshmukh, Z. Yu, C. Köroğlu, A. I. Khan, K. Schauble, K. C. Saraswat, E. Pop, and H.-S. P. Wong, *Improved Gradual Resistive Switching Range and 1000× On/off Ratio in HfO_x RRAM Achieved with a $Ge_2Sb_2Te_5$ Thermal Barrier*, **Applied Physics Letters**, 121, 082103 (2022).
15. S. Deshmukh, M. M. Rojo, E. Yalon, S. Vaziri, C. Köroğlu, **R. Islam**, R. A. Iglesias, K. Saraswat, and E. Pop, *Direct Measurement of Nanoscale Filamentary Hot Spots in Resistive Memory Devices*, **Science Advances**, 8, eabk1514 (2022).
14. K. N. Nazif, A. Daus, J. Hong, N. Lee, S. Vaziri, A. Kumar, F. Nitta, M. Chen, S. Kananian, **R. Islam**, K.-H. Kim, J.-H. Park, A. Poon, M. L. Brongersma, E. Pop, K. C. Saraswat, *High-Specific-Power Flexible Transition Metal Dichalcogenide Solar Cells*, **Nature Communications**. 12, 7034 (2021).
13. A.I. Khan, A. Daus, **R. Islam**, K. M. Neilson, H. R. Lee, H.-S. P. Wong, and E. Pop *Ultralow-switching Current Density Multilevel Phase-change Memory on a Flexible Substrate*, **Science**, 373 (6560), 1243-1247 (2021).
12. K. N. Nazif, A. Kumar, J. Hong, N. Lee, **R. Islam**, C. J. McClellan, O. Karni, J. v. d. Groep, T. F. Heinz, E. Pop, M. L. Brongersma, and K. C. Saraswat, *High-Performance p–n Junction Transition Metal Dichalcogenide Photovoltaic Cells Enabled by MoO_x Doping and Passivation*, **Nano Letters**, 21(8), 3443-3450 (2021).
11. A.I. Khan, H. Kwon*, **R. Islam***, C. Perez, M.E. Chen, M. Asheghi, K.E. Goodson, H.-S. P. Wong, and E. Pop *Two-Fold Reduction of Switching Current Density in Phase Change Memory Using Bi_2Te_3 Thermoelectric Interfacial Layer*, **Electron Device Letters**, 41 (11), 1657 - 1660 (2020). (***Equal Contribution**)
10. **R. Islam**, H. Li, P.-Y. Chen, W. Wan, H.-Y. Chen, B. Gao, H. Wu, S. Yu, K. Saraswat, and H.-S. P. Wong, *Device and Materials Requirements for Neuromorphic Computing*, **Journal of Physics D: Applied Physics**, 52, 113001 (2019). (invited)
9. A. Kumar, **R. Islam**, D. Pramanik, and K. C. Saraswat, *On the Limit of Defect Doping in Nickel Oxide*, **Journal of Vacuum Science & Technology A**, 37 (2), 021505 (2019).
8. **R. Islam**, and K. Saraswat, *Limitation of Optical Enhancement in Ultra-thin Solar Cells Imposed by Contact Selectivity*, **Scientific Reports**, 8, 8863 (2018).
7. M. Xue*, **R. Islam***, Y. Chen*, J. Chen, C.-Y. Lu, A. M. Pleus, C. Tae, K. Xu, Y. Liu, T. I. Kamins, K. C. Saraswat, and J. S. Harris, *Carrier-selective Interlayer Materials for Silicon Solar Cell Contacts*, **Journal of Applied Physics**, 123, 143101 (2018). (***Equal Contribution**)
6. M. Xue*, **R. Islam***, A. C. Meng*, Z. Lyu, C.-Y. Lu, C. Tae, M. R. Braun, K. Zang, P. C. McIntyre, T. I. Kamins, K. C. Saraswat, and J. S. Harris,*Contact Selectivity Engineering in 2 μm Thick Ultrathin c-Si Solar Cell using Transition-Metal Oxides Achieving Efficiency of 10.8%*, **ACS Applied Materials and Interfaces**, 9 (48), 41863–41870 (2017). (***Equal Contribution**)
5. N. El-Atab, T. G. Ulusoy, A. Ghobadi, J. Suh, **R. Islam**, A. K. Okyay, K. C. Saraswat, and A. Nayfeh, *Cubic-phase Zirconia Nano-island Growth using Atomic Layer Deposition and Application in Low-power Charge-trapping Nonvolatile-memory Devices*, **Nanotechnology**, 28, 44 (2017).
4. **R. Islam**, G. Chen, P. Ramesh, J. Suh, N. Fuchigami, D. Lee, K. A. Littau, K. Weiner, R. T. Collins, and K. C. Saraswat,*Investigation of the Changes in Electronic Properties of Nickel Oxide (NiO_x) Due to UV/Ozone Treatment*, **ACS Applied Materials and Interfaces**, 9 (20), 17201–17207, (2017).
3. **R. Islam**, K. N. Nazif, and K. C. Saraswat, *Si Heterojunction Solar Cells: A Simulation Study of the Design Issues*, **IEEE Transactions on Electron Devices**, 63, 12 (2016).
2. **R. Islam**, G. Shine and K. C. Saraswat, *Schottky Barrier Height Reduction for Holes by Fermi Level Depinning using Metal/Nickel Oxide/Silicon Contacts*, **Applied Physics Letters**, 105, 18 (2014).
1. M. Z. Baten, **R. Islam**, E. M. Amin and Q. D. M. Khosru, *Prospect of Charge Enhancement by Increasing Top Oxide Thickness of Silicon-on-Insulator Fin Field Effect Transistors*, **Applied Physics**

Letters, 99, 10 (2011).

Journal Manuscripts {under Review/in Preparation}

3. R. Munde, N. Vaillancourt, H.-R. Chuang, C. Gu, Y. Wang, **R. Islam**, *3D Integrated System for Advanced Intelligent Computing*, submitted to **Advances in Physics: X**. (under Review)
2. Y. Wang, M. S. Shahriar, L. Fernandes, N. Vaillancourt, S. Soliman, A. Padovani, V. Lunardelli, G. Thareja, A. I. Khan, M. S. Hasan, **R. Islam**, *Energy-efficient and scalable physical reservoir computing: through integrated long- and short-term memory in silicon ferroelectric transistors*, in preparation for submission to **Nature Electronics**. (in Preparation)
1. R. Munde, H.-R. Chuang, B. C. Wyatt, C. Gu, B. Anasori, **R. Islam**, in preparation for submission to **Journal of Applied Physics**. (in Preparation)

Conferences

10. R. Munde, B. C. Wyatt, K. K. Kamarth, B. Anasori, **R. Islam**, *High-throughput Thermal Conductivity Mapping for 2D MXene via Probe Thermal Resistance Calibration in Scanning Thermal Microscopy (SThM)*, accepted for oral presentation in **MRS Fall Meeting**, Boston, MA, November 2025.
9. **R. Islam**, M. McBriarty, M. Laudato, R. Clarke, S. Hoang, C. Chen, G. Panaman, K. Littau, *Tuning Coercive Field and Polarization in Inherently Ferroelectric HZO Film Deposited using HfD-04 and ZrD-04*, **21**st **International Conference on Atomic Layer Deposition**, Virtual Meeting, June 2021.
8. M. Xue, **R. Islam**, J. Chen, Z. Lyu, Y. Chen, D. DeWitt, A. Pleus, C. Tae, C.-Y. Lu, K. Zhang, J. Jia, Y. Huo, T. Kamins, K. Saraswat, J. Harris, *Ultra-Thin Crystalline Silicon Solar Cells with Nickel Oxide Interlayer as Hole-selective Contact*, **43**rd **IEEE Photovoltaic Specialist Conference**, Portland, OR, June 2016.
7. **R. Islam**, K. N. Nazif, K. Saraswat, *Optimization of Selective Contacts in Si Heterojunction Photovoltaic Cells Considering Fermi Level Pinning and Interface Passivation*, **43**rd **IEEE Photovoltaic Specialist Conference**, Portland, OR, June 2016.
6. **R. Islam**, G. Chen, P. Ramesh, R. Collins, K. Saraswat, *Resistivity Control of Nickel Oxide by Defect Doping Through UV/Ozone Treatment*, **MRS Spring Meeting**, Phoenix, AZ, March 2016.
5. **R. Islam**, N. Fuchigami, P. Ramesh, D. Lee, K. Littau, K. Weiner, K. Saraswat, *Tuning Stoichiometry in Atomic Layer Deposited NiO_x by Changing Deposition Temperature*, **MRS Spring Meeting**, Phoenix, AZ, March 2016.
4. P. Ramesh, **R. Islam**, D. Lee, K. Weiner, K. Saraswat, *Control of Resistivity and Stoichiometry in Atomic Layer Deposited Titanium Dioxide Using Rapid Thermal Annealing*, **MRS Spring Meeting**, Phoenix, AZ, March 2016.
3. **R. Islam**, P. Ramesh, J. H. Nam and K. C. Saraswat, *Nickel Oxide Carrier Selective Contacts for Silicon Solar Cells*, **42**th **IEEE Photovoltaic Specialist Conference**, New Orleans, LA, June 2015.
2. S. Deshmukh, **R. Islam**, C. Chen, E. Yalon, K. C. Saraswat, E. Pop, *Thermal Modeling of Metal Oxides for Highly Scaled Nanoscale RRAM*, **The 2015 International Conference on Simulation of Semiconductor Processes and Devices (SISPAD)**, Washington, DC, September 2015.
1. **R. Islam** and K. C. Saraswat, *Metal/Insulator/Semiconductor Carrier Selective Contacts for Photovoltaic Cells*, **40**th **IEEE Photovoltaic Specialist Conference**, Denver, CO, June 2014.

Book Chapters

1. Z. Wang, S. Nasrin, **R. Islam**, A. Haque, and M. A. U. Karim, *Emerging Memories and Their Applications in Neuromorphic Computing*, **Nanoelectronics: Physics, Materials and Devices**, chapter 13, pp. 305-357, Elsevier ©2023, ISBN: 978-0-323-91832-9

Pre-prints

2. **R. Islam**, S. Qin, S. Deshmukh, Z. Yu, C. Köroğlu, A. I. Khan, K. Schauble, K. C. Saraswat, E. Pop, and H.-S. P. Wong, *Improved Gradual Resistive Switching Range and 1000× On/off Ratio in*

HfO_x RRAM Achieved with a $Ge_2Sb_2Te_5$ Thermal Barrier, **https://arxiv.org/abs/2203.12190**. (Published in Applied Physics Letters in 2022)

1. J. Suh, P. Ramesh, A. C. Meng, A. Kumar, A. Kumar, S. Gupta, **R. Islam**, P. C. McIntyre, K. Saraswat, *Low Resistance III-V Hetero-contacts to N-Ge*, **arXiv: 2106.15099**. (Accepted in 2017 International Conference on Solid State Devices and Materials)

PATENTS

- **R. Islam**, M. Laudato, R. Waldman, **Ferroelectric Tunnel Junction with multilevel switching**, WO Patent. App. No. WO202300004379A1 (2023).
- A. I. Khan, H. Kwon, **R. Islam**, H.-S. P. Wong, K. E. Goodson, M. Asheghi, E. Pop, **Low-Power Phase Change Memory Technology with Interfacial Thermoelectric Heating Enhancement**, US Patent App. 17/498369 (2022).
- K. N. Nazif, **R. Islam**, J.-H. Park, K. C. Saraswat, **Tandem solar cells having a top or bottom metal chalcogenide cell**, US Patent App. 17/288689 (2021).

INVITED TALKS

- **Materials and Devices for Intelligent Systems on Flexible Platform; Prospects and Challenges**, in special session on Flexible Electronics & Displays, *IEEE Flexible Electronics Technology Conference*, Vancouver, BC, Canada August 2025.
- **Device and Materials Requirement for Neuromorphic Computing**, *MRS Spring Meeting*, Phoenix, AZ, May 2019.
- **Improving Analog Switching in RRAM through Thermal Engineering**, *Advanced Memory Device Laboratory*, CEA-Leti, Grenoble, France, July 2018.
- **Design of Metal Oxide Carrier Selective Contacts for Silicon Photovoltaics**, *Department of Physics and Astronomy Colloquium*, San Francisco State University, San Francisco, CA, February 2017.

JOURNAL REVIEWERSHIP

- Science Advances, ACS Applied Materials & Interfaces, Nano Letters, IEEE Electron Device Letters, Journal of Electron Devices Society, IEEE Transactions on Electron Devices, Applied Physics Letters, Semiconductor Science and Technology