# 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

## 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.

## 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.*
- **Brain-CA Technologies Development Grant:** Role - PI, Industry support for joint development of proof-of-concept CMOS+X system, *Award to PI: $105,915.*
- **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), Zeyu Cao (PhD, 2025 - present), Hyeonjun Bae (PhD, 2025 - present), Noah Vaillancourt (MS, 2025 – present), Congke Gu (MS, 2025 - present), Nathan Clark (Undergrad), Keegan Miller (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)
- MSE 502 - Defects in Solids

**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 incubated by Purdue Research Foundation (PRF) on commercializing 3D gain cell memory
- Awarded the SBIR phase - I grant 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.

## OUTREACH ACTIVITIES & SERVICE

**Technical Program Committee** **Device Research Conference**
*Member* 2026
- TPC members handle technical part of the conference organization, including, paper review and selection, invited speaker nomination, organizing focus sessions.

**NWO-JST Joint Call for Proposal** **Dutch Research Council**
*International Expert Reviewer* Dec. 2025
- International expert reviewer for the proposal submitted to the joint call between Dutch Research Council (NWO) and Japan Science and Technology (JST) agency on unconventional information processing.

**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.
- Served 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

17. R. Munde, N. Vaillancourt, H.-R. Chuang, C. Gu, Y. Wang, **R. Islam**, *3D Integrated System for Advanced Intelligent Computing*, **Advances in Physics: X**, 10(1) (2025). [invited]
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}

2. Y. Wang, M. S. Shahriar, S. Soliman, N. Vaillancourt, L. Fernandes, A. Padovani, A. I. Khan, M. S. Hasan, **R. Islam**, *A Dual-Memory Ferroelectric Transistor Emulating Synaptic Metaplasticity for High-Speed Reservoir Computing*, submitted to **Advanced Electronic Materials**. [**arXiv:2511.07830**] (under review)
1. R. Munde, H.-R. Chuang, **R. Islam**, *High-throughput Parasitic-independent Probe Thermal Resistance Calibration for Robust Thermal Mapping with Scanning Thermal Micrsocopy*, submitted to **Journal of Applied Physics**. [**arXiv:2511.09960**] (under review)

## 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)*, presented 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*, **arXiv: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.
- **Heterogeneous Integration: Solving Materials and Device Challenges for Intelligent Computing Hardware**, talk as an invited visitor to the ECE department, *University of California, Los Angeles*, Los Angeles, CA, USA, May 2025. (Host: *Christina Fragouli*)
- **Device and Materials Requirements 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, Journal of Vacuum Science and Technology A.