Kamruzzaman Joty

Email: kjoty@smu.edu Mobile: 945-266-3358 LinkedIn: kamruzzamanjoty

Education

Southern Methodist University Dallas, TX
Doctor of Philosophy in Mechanical Engineering, *Dec 2027 (exp.)* CGPA: 3.92
Thesis Topic: Engineering DNA Origami–Integrated Solid-State Hybrid Nanopores for Protein and Single-Molecule Sensing
Advisor: Prof. Dr. MinJun Kim

SEGi University Selangor, Malaysia
Bachelor of Engineering in Mechanical Engineering, *Feb 2022* CGPA: 3.87
Thesis Topic: Numerical Investigation of Onera M6 Forward and Backward Swept C-Wing Configuration at Supersonic Speed
Advisor: Engr. Vincent Tai

Research Experience

Research Assistant: Dallas, TX
SMU Mechanical Engineering Department
Advisor: Prof. Dr. MinJun Kim *Jan 2023 - Present*

Heterogenous Multilayer Solid-State Nanopore Fabrication and Single Molecule Analysis. Developed a novel chemically tuned dielectric breakdown (CT-CDB) method to fabricate heterogeneous multilayer nanopores composed of SiN_x integrated with 2D materials (graphene, MoS_2, hBN) for single-molecule biosensing. Conducted protein translocation experiments demonstrating enhanced sensing capabilities and applied machine learning algorithms achieving over 96% accuracy for real-time structural classification. Work submitted to Nature Communications, highlighting interdisciplinary expertise spanning nanofabrication, materials science, biophysics, and artificial intelligence.

Nanopore-Based Dual-Mode Analysis of DNA-Templated Silver Nanoclusters. Designed and fabricated solid-state nanopores to study the translocation behavior of DNA/AgNCs in various electrolytes. Demonstrated voltage- and pH-dependent stability differences between KNO_3 and KCl environments using fluorescence correlation and current blockade analysis. Results established AgNCs as potential ionic-responsive nanosensors, enhancing metallo-DNA understanding and advancing solid-state nanopore biosensing platforms.

DNA Origami–Integrated Hybrid Nanopores for Protein Detection. Engineered hybrid solid-state nanopores by integrating DNA origami nanostructures to improve analyte capture and signal resolution. Demonstrated significantly enhanced sensitivity for holo-human serum transferrin (holo-hSTf) protein detection. Highlighted the role of DNA–protein interactions beyond spatial confinement, paving the way for ultrasensitive biosensing tools for disease biomarkers.

Solid-State Nanopore Detection of Ultra-Short KYCDE Peptides. Utilized SixNy nanopores to investigate translocation dynamics of ultra-short peptides. Systematically evaluated peptide–pore interaction as a function of nanopore diameter, voltage, and analyte concentration. Identified aggregation behavior and signal-masking challenges in peptide

detection, offering insight into optimizing nanopore systems for single-molecule proteomics and peptide sequencing.

Undergraduate Research: Selangor, Malaysia
SEGi Department of Mechanical Engineering

Aerodynamic Performance of C-Wing Configurations in Supersonic Flow. Numerically studied the Onera M6 wing with forward and backward C-wing sweep using ANSYS Fluent. Compared the aerodynamic performance of these swept configurations to a planar baseline to assess drag reduction and sonic boom mitigation at subsonic and supersonic speeds. Aimed to support aerospace innovations in noise reduction and fuel efficiency.

Review of 3D Printing Applications in Orthopedic Surgery. Conducted a literature review on the use of additive manufacturing in orthopedic procedures. Emphasized how 3D printing enhances surgical planning, implant customization, and procedural accuracy, leading to better patient outcomes and greater surgical efficiency in complex anatomical scenarios.

Publications

Patents

Joty, K.; Gu, C.; Kim, M. J. Heterogeneous Multilayer Nanopores. US Patent Serial No. 63/998,374. Filing Date: March 6, 2026 (*Pending*)

Peer Reviewed Journal

Joty, K.*; Gu, C.*; Thyashan, N.; Vlassiouk, I.; Collins, L.; Zhang, X.; Nelson, C.; Taton, N.; Lee, S.; Kim, M. J. Heterogenous Multilayer Nanopores via Chemically Tuned Dielectric Breakdown for Single-Molecule Sensing. *Small* **2026**, e13242. *Equal Contributors

Joty, K.; Hong, S.; Ghimire, M. L.; Kim, S.; Walker, J. N.; Brodbelt, J. S.; Yeh, H.-C.; Kim, M. J. Solid-State Nanopore Analysis of DNA-Hosted Silver Nanoclusters: Voltage-Dependent Translocation and Electrolyte Stability. *ACS Applied Materials & Interfaces* **2025**, *17* (27), 39407-39419. https://doi.org/10.1021/acsami.5c02405.

Gu, C.; **Joty, K.**; O'Donohue, M.; Thyashan, N.; Hu, L.; Kim, M. J.; Lee, S.; Kim, M. J. Detection of Ultra-Short KYCDE peptides using Si_xN_y nanopores. *Electrophoresis* **2025**. https://doi.org/10.1002/elps.8122.

Joty, K.; Ghimire, M. L.; Kahn, J. S.; Lee, S.; Alexandrakis, G.; Kim, M. J. DNA Origami Incorporated into Solid-State Nanopores Enables Enhanced Sensitivity for Precise Analysis of Protein Translocations. *Analytical Chemistry* **2024**, *96* (44), 17496–17505. https://doi.org/10.1021/acs.analchem.4c02016.

Submitted to Peer Reviewed Journal

Joty, K.; Gu, C.; Lee, S.; Kim, M. J. Directional Single-Protein Transport Enabled by 2D Material Heterointerfaces in Solid-State Nanopores: Implications for Single-Molecule Sensing. *(In Review)*

Gu, C.; Zhu, X; Khatri, S.; Thyashan, N.; **Joty, K.**; Kim, M. J. Geometric Confinement in Solid-State Nanopores Enables Single-Molecule Discrimination of Ferritin Subunits and Translocation Bias. *(In Review)*

Gu, C.; Lee, J. W.; **Joty, K.**; Leon, M.; Khatri, S.; Janeesha, M.; Hing, S.; Kim, M. J. Single-Molecule Fingerprinting of Dendrimer-Peptide Conjugates with Defined Loading Ratios Using Solid-State Nanopores. *(In Review)*

Peer Reviewed Conference Proceeding

Joty, K., Janasekaran, S., Tai, V. C., Urasim, M.; Review of 3D printing applications in orthopedic surgery. *AIP Conf. Proc.* 27 November 2023; 2847 (1): 040011. https://doi.org/10.1063/5.0165255.

Joty, K.; Gu, C.; Lee, S.; Kim, M. J. Direction-Aware Signal Analysis for Protein Translocation in Multilayer Solid-State Nanopores. *IEEE DCAS* **2026**. *(Accepted)*

Joty, K.; Khatri, S.; Janeesha, M.; Gu, C.; Lee, S.; Kim, M. J. Influence of Heterogeneous 2D Material Interfaces on Protein Translocation in Solid-State Nanopores. *IEEE Biosensors* **2026**. *(In Review)*

Honors & Awards

Engineering is Art at SMU Lyle School of Engineering (2025), Best Presentation Award at SMU R&I Week Poster Competition (2024), IMechE Project Award (2022), Frederic Barnes Waldron Best Student Award (2020), 7 Dean's List Awards (2017-2022), 3 High Achievers Awards (2018-2019), Merit Scholarship (2017-2020), IMechE Conference Grant (2018)

Teaching Experience

Southern Methodist University
Mechanical Engineering Department

ME 2342: Fluid Mechanics, Teaching Assistant *Fall 2024*
ME 2131: Thermodynamics, Teaching Assistant *Spring 2025*
ME 3132: Heat Transfer, Teaching Assistant
ME 701C: Nano-Biomanufacturing, Laboratory Assistant

Supervised and mentored two student groups per course in conducting laboratory experiments, guiding them through the planning, execution, and analysis of scientific investigations. Effectively communicated theoretical concepts and experimental principles during lab sessions. Provided detailed feedback and evaluated student performance through the assessment of professional-grade laboratory reports.

Industrial Experience

SA Classic Properties Sdn. Bhd. Kuala Lumpur, Malaysia
Chief Advising Officer *Mar 2022 - Dec 2022*
Managing overall operation (technical and management) of the company

Bangladesh-India Friendship Power Company Ltd. Khulna, Bangladesh
Maitree Super Thermal Power Plant (2×660 MW) *Jun 2021 - Sept 2021*
Industrial Trainee
Worked as an Assistant Project Manager to oversee and supervise the erection of the power plant liaising mechanical department

Presentations

Toward Smart Nanopores: Machine Learning Enabled Biosensing with Multilayer Solid-State Nanopores for Molecular Diagnostics (UNT AI4BM Symposium 2025).
DNA Origami Incorporated into Solid-State Nanopores Enables Enhanced Sensitivity for Precise Analysis of Protein Translocations (North Texas BME Symposium, 2024).

DNA Origami Incorporated into Solid-State Nanopores Enables Enhanced Sensitivity for Precise Analysis of Protein Translocations (SMU Research & Innovation Week, 2024).
Prevention of Pollution by Ships, Delegate of Sweden under International Maritime Organization (IMO) Council (Asia Youth International Model United Nation Conference 2018, Bangkok, Thailand).

Strategic Engagements

Lyle Senator at 112th SMU Student Senate Body, Graduate Student Member of Alpha Chi National College Honor Society, Associate Member (AMIMechE) at Institution of Mechanical Engineers (IMechE) (2018-2023), University Liaison Officer at Institution of Mechanical Engineers (2019-2022), Treasurer at The Institution of Engineers Malaysia SEGi Student Chapter 2019, Ambassador at International Global Network (2019-2021), Liaison Officer at Asia World Model United Nations II (2019-2020), Director of Logistics at Hult Prize SEGi University 2018.

Technical Proficiencies

Park Systems NX-12 AFM, JEOL SEM, Axopatch system, ANSYS, MATLAB, Labview, Autodesk Inventor & AutoCAD, Blender, Adobe Photoshop, Microsoft Office, Python ML, Origin pro.

Community Impacts

American Red Cross Dallas, TX
Transport Specialist, North Texas Region *2023 - Present*
Transport blood or blood products among Red Cross laboratories, hospitals and collection sites.

Dallas Regional Science and Engineering Fair Dallas, TX
Category Judge *2025*
Evaluated projects in Biomed., Engineering Tech. and Material Science Category.

Governor's Science and Technology Champions' Academy Dallas, TX
Instructor *2025*
Mentored and supervised award-winning high school researchers during the GSTCA at SMU, guiding hands-on nanopore experiments and data analysis.

Affiliation

Student Member (000103769537) of The American Society of Mechanical Engineers.

References

Dr. Minjun Kim
Dept. of Mechanical Engineering
Lyle School of Engineering
Southern Methodist University
mjkim@lyle.smu.edu

Dr. Georgios Alexandrakis
Dept. of BioEngineering
University of Texas at Arlington
galex@uta.edu

Dr. Madhav Ghimire
LTMD Engineer
Intel Corporation
madhav.ghim@gmail.com

Dr. Tan Yong Chai
Dean of FoEBEIT
SEGi University Malaysia
tanyongchai@segi.edu.my