

Musa Ibne Mannan

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Summary

Mechanical engineering Ph.D. candidate working on electrochemical biosensors, CVD synthesis of 2D materials, and machine learning for process transfer. Built and commissioned a dual-zone CVD line from an empty bench, ran 139 MoS₂ growths, and trained a Random Forest on calibrated substrate temperature that reached 89.3% accuracy and carried a working recipe into a different reactor on the first attempt. Co-developed a screen-printed carbon biosensor detecting tRNA-derived fragments at a 0.4 nM limit of detection. Six journal papers and proceedings, two as first author. Seeking device fabrication, process development, and materials machine learning roles.

Education

Doctor of Philosophy (Ph.D.) in Mechanical Engineering Aug 2023 – Present
Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas, Richardson, TX
Concentration: Manufacturing and Design Innovations GPA: 3.62
Master of Science in Mechanical and Manufacturing Engineering (ABET accredited) Aug 2021 – May 2023
Ingram School of Engineering, Texas State University, San Marcos, TX GPA: 3.75
Thesis advisor: Dr. Namwon Kim

Technical Skills

Failure Analysis and Testing: Root cause analysis, fracture surface examination (SEM, EDAX), mechanical testing (tensile, flexural, Izod impact; MTS 810), thermal analysis (TGA, DSC, TMA), design review, field error resolution.

Simulation and CAD: Abaqus finite element analysis (transient heat transfer, thermal stress, plasticity from true stress-strain data, mesh convergence, 2D plane stress and 3D solid elements), SolidWorks, AutoCAD, CATIA, Mastercam, basic CFD.

Programming and Data Analysis: Python (data analysis pipelines, Random Forest, XGBoost), MATLAB (numerical methods, custom FEM implementation, Gauss quadrature, multi-objective genetic algorithms).

Experimental and Fabrication: High-vacuum chemical vapor deposition (CVD) design and commissioning, pulsed laser deposition, Raman, XPS, XRD, SEM/EDX, ellipsometry, Hall measurement, screen-printed electrode functionalization (oxygen plasma, EDC/NHS), cyclic and differential pulse voltammetry, FDM/SLA/Markforged printing, twin-screw extrusion, CNC (HAAS VF-3), laser cutting, waterjet, TIG and arc welding, mill and lathe.

Professional: Technical report writing, publication-quality figures and presentations, EHS and OSHA compliance, procurement and inventory management, Adobe Creative Suite.

Professional Experience

Research Assistant and Lab In-Charge Jun 2024 – Present
Leem Research Group, The University of Texas at Dallas, Richardson, TX

- Independently designed, assembled from the ground up, troubleshoot, and operated high-vacuum CVD furnaces, a hydrogen generator, and integrated Raman spectroscopy instrumentation, then optimized the resulting process.
- Led complete laboratory build-out including procurement, equipment installation, safety compliance, and inventory management while running concurrent computational and experimental programs.
- Applied Python-based data analysis pipelines and ensemble machine learning (Random Forest, XGBoost) to optimize multi-parameter mechanical system performance and materials synthesis processes.

Graduate Teaching Associate (Instructor of Record) Aug 2025 – Present
The University of Texas at Dallas, Richardson, TX

- Instructor of record for ECS 1100 within a 300-student course, delivering curriculum, mentoring, and assessment for an assigned section; lecture on engineering fundamentals including mechanics and design. Cumulative teaching load across UT Dallas and Texas State exceeds 850 students.

Assistant and Site Engineer Sep 2018 – Jun 2019
Washillah Engineering Services (Partex Petro Ltd. and CUFL projects), Bangladesh

- Led on-site teams of 28 to 35 engineers and contractors for large-scale mechanical and piping projects (condensate refinery and boiler re-tubing); enforced EHS and OSHA standards and managed field operations under tight deadlines.
- Performed root cause analysis and resolved over 120 design and implementation errors in mechanical systems and

structures, saving approximately 30,000 man-hours and \$1M while maintaining quality and schedule.

- Coordinated cross-functional teams, client interfaces, material logistics, and quality control in high-stakes industrial field environments.

Graduate Instructional Assistant

Aug 2023 – May 2024

The University of Texas at Dallas, Richardson, TX

- Graded assignments and exams and tutored 136 students in Kinematics and Dynamics (MECH 3350) and approximately 60 in Mechanics of Materials (MECH 2320).
- Delivered substitute lectures and assisted students with computational modeling, FEA, and CAD troubleshooting.

Graduate Instructional Assistant

Sep 2021 – May 2023

Texas State University, San Marcos, TX

- Mentored three senior design teams (15 students) to completion on industry-sponsored mechanical engineering capstone projects; provided hands-on guidance in CAD, FEA, prototyping, and mechanical system design.

Selected Projects

- **Machine Gun Barrel Thermal and Stress Failure Analysis (Abaqus FEA):** Calculated firing pressure analytically at 130.5 MPa, then ran transient heat transfer and von Mises stress analysis under sustained high-rate firing; evaluated AISI 4140, 316L, and ASTM A656 Grade 7 for thermal gradients and failure risk.
- **Cantilever Beam FEA and Mesh Convergence Study (Abaqus, MATLAB):** CPS4, CPS8, and C3D8 elements across three mesh densities; 3D deflection error fell from 84% to 22%, 2D mid-span stress error from 94% to 8.6%. Verified against custom MATLAB code using 2x2 Gauss quadrature.
- **Biocomposite Characterization and Failure Diagnosis:** Designed, extruded, and 3D-printed silane-treated natural fiber composites; used SEM/EDAX, tensile and flexural testing, and thermal analysis to diagnose interfacial adhesion issues, fiber-size effects, and resulting mechanical failure modes.
- **rGO Thin-Film Processing and Characterization:** Independently designed and executed pulsed laser deposition and annealing experiments; performed full characterization (XPS, Raman, XRD, ellipsometry, Hall measurement, low-temperature transport).

Publications

1. **Musa Ibne Mannan**, Varin Kansal, Premesh N. Mistry, et al. "Closing the Reproducibility Gap in MoS₂ CVD: Zero-Shot Cross-Reactor Transfer of Machine-Learned Growth Conditions via Thermal Calibration." *Advanced Materials* (Wiley). Under review.
2. **Musa Ibne Mannan**, Premesh Mistry, Varin Kansal, et al. "AI-Enabled CVD Synthesis, Quality Control, and Autonomous Manufacturing of 2D Materials." *npj Advanced Manufacturing* (Springer Nature), 2026. DOI: 10.1038/s44334-026-00109-5.
3. Wasi Shadman, **Musa Mannan**, Tanzila Kamal Choity, et al. "Electrochemical Detection of tRNA-Derived Fragment (tRF) Biomarkers Using a Multi-Functionalized Carbon Electrode." *Surfaces and Interfaces* 83, 108446, 2026. DOI: 10.1016/j.surfin.2026.108446.
4. Mohammad Shahed H.K. Tushar, **Musa Ibne Mannan**, Afra Azmain. "Exhaust Gas After Treatment using Air Preheating and Selective Catalytic Reduction by Urea to Reduce NO_x in Diesel Engine." *Heliyon* 11(1), e42399, 2025. DOI: 10.1016/j.heliyon.2025.e42399.
5. Jitendra S. Tate, Subash Pant, **Musa I. Mannan**, et al. "Thermal and Structural Properties of Surface Treated Ragweed Fiber Reinforced Biodegradable Polylactic Acid Biocomposites." *International Journal of Composite and Constituent Materials* 8(2), 2022.
6. S. Panta, **M.I. Mannan**, et al. "Comparison of Mechanical and Morphological Properties of Ameo and Glymo Silane Treated Ragweed-PLA Bio-Composites." *CAMX 2022 Proceedings*, Anaheim, CA, 2022.

Additional Experience

Medical Scribe and ER Workflow Innovation, Augmedix

Jul 2019 – Jul 2021

Supported a California emergency room through COVID, delivering real-time documentation for 4,000+ patients. Designed and piloted the world's first remote ER scribing program, building the training curriculum from scratch and deploying the workflow across multi-site teams. Featured in *Business Insider*.

Novelist and Screenwriter (Bangla)

Feb 2016 – Present

Author of 26 published books across Bangladesh and India, written as Kishor Pasha Imon alongside full-time engineering and research work.