Mehnaj Jimy

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EDUCATION

Stony Brook University Stony Brook, NY

B.E. Chemical and Molecular Engineering, Nanotechnology Specialization Expected May 2028

Completed: Chemical Engineering Thermodynamics I-II; Material & Energy Balances; Programming for Engineers; Organic Chemistry I & Lab; General Chemistry I-II & Labs; Classical Physics I-II & Labs; Applied Calculus III-IV (Differential Equations); Ethics and Business Practice for Engineers

Current: Unit Operations Lab I, Numerical Methods for Chemical Engineering, Fluid Mechanics, Polymer Engineering, Writing in Chemical & Molecular Engineering

RESEARCH EXPERIENCE

Lee Research Group, Stony Brook University August 2026 - Present

Undergraduate Researcher

- Troubleshot poor spin-coated film quality on Si wafer coupons in a 2-person polyurethane (PU) thin-film team by designing a 3x3 DOE (design of experiments) of concentration x spin speed that seeded a Bayesian-optimization loop, reaching a 100 nm target with <5% nonuniformity (5-point ellipsometry)
- Run atomic layer deposition (ALD) and vapor-phase infiltration (VPI) equipment at a national lab (TMA/H2O alumina, DEZ/H2O ZnO) on PU films and textiles; compared flow-through vs. hold recipes, where our group found hold gave ~11x more mass gain
- Characterize thin films and precursor uptake with in-situ QCM, ellipsometry, ATR-FTIR, XRD, SEM, and STEM to link process recipes to film mass, thickness, and chemistry
- Prepared ASTM D412 tensile specimens (25-30 dog-bones, 5-6 ALD conditions) for industry partner testing
- Built Crystal Tools, a Python pipeline that cleans instrument exports and compares QCM runs across conditions

TECHNICAL PROJECTS

WM-811K Wafer Map Yield Analysis October 2026 - Present

- Ranked wafer defect patterns by excess die loss across 172,950 labeled wafer maps vs. clean baselines per map size; Edge-Ring and Edge-Loc drive 47% of yield loss (Pareto) in Python
- Showed all 8 defect patterns cluster within lots (permutation $p < 0.01$) and flagged 502 of 7,025 lots as excursions (361 Edge-Ring), indicating lot-level causes rather than isolated wafer events
- For each pattern, compiled literature-based root-cause hypotheses (etch, CMP, lithography, deposition) and the first fab checks to run
- Trained a Random Forest on 24 engineered features and a small CNN on a lot-disjoint split; the CNN reached 0.877 macro-F1 and cut defect wafers passed as clean from 8.4% to 3.7%
- Built a confidence-based review gate: holding missed defects near 5%, the CNN sends 10.3 clean wafers per 1,000 to review against 19.0 for the forest

PVD Process Monitoring & Virtual Metrology (Public Infineon Fab Data) August 2026

- Flagged multivariate process excursions in 97-channel fab equipment sensor data (4,848 AlCu and 1,740 WTi records) using PCA-based statistical process control (SPC: Hotelling T-squared, SPE/Q) in Python
- Ranked the sensor channels driving each excursion with contribution analysis, setting a root cause review order
- Predicted 17 film-thickness metrology targets with a machine-learning virtual metrology model (held-out R-squared 0.62 AlCu, 0.60 WTi), cutting prediction error 41-43% vs. a linear regression baseline
- Repeated the held-out test with identical target profiles kept together (grouped R-squared 0.54 AlCu, 0.69 WTi) to check how much profile repetition inflated the ordinary-split scores

Physics-Based ALD Reactor Model July 2026 - Present

- Modeled ALD precursor transport and surface kinetics; on a synthetic recipe, a spatial model predicted 91.1% outlet conversion vs. 97.8% well-mixed, showing the well-mixed assumption hides under-dosing near the outlet
- Added a DEZ/water ZnO case with published diffusivity and density estimates; it predicts about 0.168 nm of ZnO per cycle, close to the 0.165 nm reported at 150 C
- Built a desktop app and command-line tool on the same solver, with 22 automated tests and saved inputs, results, and code hashes for every run

ColdPlateTwin: Cold-Plate Digital Twin September 2026 - Present

- Designing a water-cooled cold-plate testbed with parametric CAD and reduced-order thermal-hydraulic models
- Built logger-data analysis for calorimetry, steady-state screening, pressure drop, and uncertainty estimation

Heat and Mass Exchange Simulator 2026

- Modeled counter-current heat exchange (effectiveness-NTU) and membrane mass transfer in Python, reporting energy and solute balance residuals for each case

Batch Reactor Simulator 2026

- Solved zero-, first-, and second-order batch kinetics with SciPy and checked each case against its analytical solution (maximum concentration error 8.3e-4 mol/L)

WORK EXPERIENCE

NYC Department of Education September 2024 - Present

Substitute Paraprofessional

- Manage challenging student interactions through calm communication, clear expectations, and appropriate escalation while supporting individual behavioral needs
- Independently supervise students and lead classroom routines and transitions, adapting to changing needs while maintaining a safe, structured environment
- Collaborate with teachers and support staff to implement individualized education plans, communicate student needs, and maintain classroom continuity

TECHNICAL SKILLS

Process & Fab: Thin film deposition, vacuum deposition, atomic layer deposition (ALD), vapor-phase infiltration (VPI), chemical vapor deposition (CVD), spin coating, cleanroom practice, DOE (design of experiments), Bayesian optimization, SPC (statistical process control), root cause analysis, yield analysis, wafer map analysis, virtual metrology, process troubleshooting

Metrology: Ellipsometry, in-situ QCM (quartz crystal microbalance), ATR-FTIR, XRD, SEM (scanning electron microscopy), STEM

Data & Software: Python (pandas, NumPy, SciPy, scikit-learn, Matplotlib), data analysis, PCA, Random Forest, MATLAB, Excel, Git, AutoCAD, DWSIM, thermal-hydraulic modeling

Lab: Wet chemistry, solution preparation, filtration, ASTM D412 tensile specimen preparation, lab safety