

MATTHEW COUPIN, PHD

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SUMMARY

Materials R&D engineer with industry and doctoral experience in coatings, 2D materials, process optimization, and advanced computational microscopy.

SKILLS

Thin-film/process R&D: multilayer metallo-ceramic coatings, process–structure–property optimization, DOE, failure analysis, SOP authoring

Vacuum processing/systems: PECVD process-development, reactive ion etching support, lab-scale sputtering, leak diagnosis, turbopumps, diffusion pumps, ion pumps, cryo traps, Penning gauges

Characterization: STEM, EELS, FIB-SEM,EDS, EBSD, electron tomography, electron diffraction, metrology

Tools: Python (scientific computing/data analysis), TEM sample preparation, machining incl. CNC, Jig/fixture fabrication, MCAD, Abaqus FEA

EXPERIENCE

The University of Texas at Austin 2020 - 2025
PhD Researcher, Materials Science & Engineering Austin, TX

- Developed quantitative STEM/EELS/electron-tomography workflows for nanoscale analysis of materials and interfaces. Performed physics-based simulation of electron scattering to validate 4D-STEM measurements.
- Co-managed operation of an aberration-corrected STEM including vacuum/cooling troubleshooting and coordination of upgrades and repairs.
- Created SOPs and trained users on advanced instrumentation workflows, including in-house pipeline for automated tomography acquisition.
- Authored or co-authored > 10 peer-reviewed papers in journals including *Nature Communications*, *ACS Nano*, and *Nano Letters*.

Apple Inc. September 2018 - October 2019
Materials Engineer, Product Design Cupertino, CA

- Developed metallo-ceramic multilayer coatings consumer electronics in a fast-paced commercial R&D environment.
- Delivered specifications for hardness, scratch resistance, corrosion resistance, and color.
- Performed in-house characterization (FIB-SEM, EDS, EBSD), coordinated CRO testing, and authored SOPs for overseas quality assurance teams.

Selected Earlier Experience

Materialprüfungsanstalt, University of Stuttgart – Summer Researcher (Abaqus FEA subroutines), Summer 2018
Tesla Motors – Manufacturing Engineering Intern (General Assembly and Paint), Summer 2017
Teva Pharmaceuticals – Chemistry, Manufacturing, and Controls Intern, Summer 2016

EDUCATION

University of Texas at Austin *PhD, Materials Science & Engineering, 2025*
GPA: 3.9 / 4.0

Massachusetts Institute of Technology *SB, Materials Science & Engineering, 2018*
GPA: 4.6 / 5.0

Dissertation

Quantitative Multiscale Methods for Scanning Transmission Electron Microscopy of Low-Dimensional Materials in Two and Three Dimensions.

Scanning transmission electron microscopy (STEM) and electron energy loss spectroscopy (EELS) were used to extract quantitative 3-dimensional measurements of material structure, electronic properties, and mass density.

Advisor: Jamie H. Warner, Director, Texas Materials Institute

Publications (* = *First or co-first author*)

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| * 3D Atomic Scale Insights into Unconventional Fragmentation of 2D ReS ₂ Monolayers into Molecular Clusters | <i>Under Review</i> |
| * Quantitative Nanoscale Structure Determination in Polyamide Desalination Membranes by Correlated Electron Tomography and Spectroscopy | ACS Nano 2026 |
| Ozonated Monolayer Graphene for Extended Performance and Durability in Hydrogen Fuel Cell Electric Vehicles | ACS Nano 2025 |
| Scalable Bottom-Up Synthesis of Nanoporous Hexagonal Boron Nitride (h-BN) for Large-Area Atomically Thin Ceramic Membranes | Nano Letters 2025 |
| Protein-Enabled Size-Selective Defect-Sealing of Atomically Thin 2D Membranes for Dialysis and Nanoscale Separations | Nano Letters 2024 |
| Low-Temperature Synthesis of WSe ₂ by the Selenization Process under Ultrahigh Vacuum for BEOL Compatible Reconfigurable Neurons | ACS App. Mat. & Interf. 2024 |
| Ultra-fast switching memristors based on two-dimensional materials | Nature Communications 2024 |
| * Moiré Superlattice Structure of Pleated Trilayer Graphene Imaged by 4D Scanning Transmission Electron Microscopy | ACS Nano 2023 |
| * Mapping Nanoscale Electrostatic Field Fluctuations Around Graphene Dislocation Cores Using 4D-STEM | Nano Letters 2023 |
| Self-Compliant Threshold Switching Devices with High On/Off ratio by Control of Quantized Conductance in Ag Filaments | Nano Letters 2023 |
| Lattice-Mismatch-Driven Small-Angle Moiré Twists in Epitaxially Grown 2D Vertical Layered Heterostructures | Advanced Materials 2022 |
| Phase Engineering of Palladium Selenide Using Chalcogen Flux Control | Chemistry of Materials 2022 |
| Atomic-Scale Insights into the Lateral and Vertical Epitaxial Growth in Two-Dimensional <i>Pd₂Se₃-MoS₂</i> Heterostructures | ACS Nano 2022 |
| * Mapping 1D Confined Electromagnetic Edge States in 2D Monolayer Semiconducting <i>MoS₂</i> Using 4D-STEM | ACS Nano 2022 |