

Alex Echols (she/her)

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Education

Carnegie Mellon University, Pittsburgh, PA

B.S. Materials Science and Engineering, GPA: 3.23/4.0, Expected Graduation May 2025

Relevant Coursework

Materials Science and Engineering

- Structure of Materials
- Thermodynamics of Materials
- Defects in Materials
- Transport in Materials
- Phase Relations and Diagrams
- Microstructure and Properties I
- Additive Manufacturing and Materials
- Quantum Phys. and the Structure of Matter
- Introduction to Materials Characterization
- Selection and Performance of Materials
- Introduction to Polymer Science
- Methods of Computational Materials Science
- Molecular Simulation of Materials
- MSE Capstone I & II
- Nanostructured Materials
- Hackerfab 1: Building the Fab

Computer Science

- Fundamentals of Programming and Computer Science
- Introduction to Data Structures

Mathematics

- Concepts of Mathematics
- Differential and Integral Calculus
- Integration and Approximation
- Linear Algebra and Vector Calculus for Engineers
- Differential Equations
- Engineering Statistics and Quality Control

Other

- Writing about Data
- Rhetoric, Science, and the Public Sphere
- Structural Design for Theatre I

Publications

Conference Papers

A.Pathak, H. Ramasubramanian, A. Echols, J. Malen, A.McGaughey, (Nov. 7, 2024)

"Molecular Dynamics and First-Principles Approach for Phonon Scattering in Al_xGa_{1-x}N Alloys: Role of Mass- and Force Constant-Disorder", IMECE2024, Portland, OR

Research Experience

Automatic Grain Segmentation Methods for Metals

Research Advisor: Amanda Krause

Carnegie Mellon University, Jan. 2025 - Present

- Research image segmentation methods and implement them in python code
- Adapt generalized image segmentation methods to the segmentation of grain boundaries in metal systems
- Develop professional quality code in preparation for an open source release on Github
- Write and publish a first author paper on the novel methodology developed on this project

Molecular Dynamics (MD) Simulations of AlGaN Alloys

Research Advisor: Alan McGaughey

Carnegie Mellon University, Summer 2024

- Modified industry standard MD (LAMMPS) source code, including force calculations for certain potentials
- Implemented novel interpolation methods for interatomic force constants
- Used MD simulations (LAMMPS) to quantify a number of material properties including lattice constants, elastic properties, and thermal conductivity in alloy systems

Professional Experience

Materials Simulation and Testing Intern

Managers: Jonathan Trenkle, Brady Adams

Markforged, Waltham, MA, Summer 2023

- Characterized the properties of additively manufactured carbon fiber-nylon-fiberglass composites, using standard laboratory techniques and equipment
- Modified existing FEA code to implement composite materials based on measured property values
- Cleaned and debugged FEA code for commercial software launch

iD Tech, Pittsburgh, PA
Instructor, Summer 2022

Manager: Briar Harrison

- Worked with children ages 6-17, teaching a variety of STEM concepts, including Python, Javascript, and basic electronics skills

Leadership Experience

Shop Manager

Scotch 'n' Soda Theatre, Fall 2023 through Spring 2024

- Oversaw a 7 person shop staff, including organizing regular meetings and ensuring that all tasks were completed in a timely manner
- Coordinated equipment rentals to other organizations within Carnegie Mellon University
- Worked with other organization leaders to create a more comprehensive and accessible documentation system

Carpentry Shop Manager

Scotch 'n' Soda Theatre, Fall 2022 through Spring 2023

- Oversaw maintenance and upkeep of various power and hand tools
- Ensured proper training of all members on relevant equipment, including standardization of training procedures
- Worked to procure additional parts, equipment, and supplies as necessary

Master Carpenter

Scotch 'n' Soda Theatre, 10 Productions

- Managed the construction of theatrical sets for 10 separate productions
- Created CAD breakdowns of theatrical sets based on provided scenic designs
- Evaluated necessary supplies and created budgets using cost estimation and material selection skills
- Oversaw theatrical "load-in" and "strike", supervising up to 50 construction crew members to construct and tear-down theatrical sets

Team Captain

Steel Dragons Robotics, Fall 2020 through Spring 2021

- Oversaw FIRST Robotics (FRC) team #117 through the 2020-21 academic year
- Planned and scheduled meetings, resolved interpersonal conflicts, oversaw technical aspects of competition robot in a team with roughly 20 members
- Managed a leadership team of 8 other students, covering a variety of technical and non-technical areas
- Fundraised \$20k needed for competition expenses, robot parts, and meeting costs
- Created more thorough documentation of all roles and responsibilities to minimize knowledge loss from COVID-19 pandemic

Build Captain

Steel Dragons Robotics, Fall 2019 through Spring 2020

- Trained and advised team members on technical aspects of FRC robot construction
- Devised feasible and functional robotic system designs for competition challenges with team members
- Repaired and improved robotics systems in time and resource constrained situations with team

Relevant Projects

Open Source Atomic Layer Deposition (ALD) System, 2025

An ALD system developed with the HackerFab group at CMU

- Design of vacuum and pyrophoric compatible structures for ALD of Indium Tin Oxide (ITO)
- Collaborated with a small team to integrate smaller subsystems and solve engineering problems

boundary.py, 2025

A custom python package built for automatic grain segmentation of metals

- Features a GUI which allows quick testing of different segmentation procedures on arbitrary images
- Initially designed for additively manufactured Al, but has expanded to encompass a broader range of materials systems

MSM_MD, 2024

A custom molecular dynamics code written from the ground up in C++

- Features loading of arbitrary atomic input data, support for multiple atom types, potentials, and unit systems
- Developed individually throughout Molecular Simulation of Materials course as a part of coursework

Characterization of Cold-Sprayed 6061 Al, 2024

Comparison of wrought and cold-sprayed 6061 Al for work with Sandia National Lab

- Experimental design for measurement of various physical properties including hardness, electrical properties, and corrosion resistance
- Executed planned experiments using standard laboratory equipment and practices including ASTM testing standards
- Communicated with Sandia National Lab regarding results, experimental design, and project management as a part of MSE Capstone course project

Constant Current Laser Power Supply, 2024

Design and fabrication of a 10W, constant current laser power supply for SLM 3D printer

- Reviewed literature on power electronics including textbooks and academic papers
- Modified and combined pre-designed modules to create a circuit fitting the given constraints
- Designed PCB, selected components, and constructed power supply using hardware and software skills
- All stages, from project conception to final implementation were self-led and executed

Hollow Knight TAS Assistant, 2023

A standalone program for interfacing with information in the video game Hollow Knight

- Designed and developed main program (Python) and supplementary scripts and modifications to interface with existing game code (Lua, C#)
- Analyzed in-game data to create accurate models for in-game behavior of player character and dynamic objects
- Learned the details of various communication methods including sockets and direct memory management

Skills

Software

Python (9+ Years)
C# (4+ Years)
C++ (3+ Years)
MATLAB (3+ Years)

OnShape (5+ Years)
KiCAD (3+ Years)

Google/MS Office Suite (10+ Years)

ImageJ (1+ Year)
LAMMPS (1 Year)
Linux (1 Year)

Hardware

Basic Wood/Metalworking tools (10+ Years)
3D Printing (9+ Years)
Soldering (9+ Years)

Lathe (3+ Years)
Manual Mill (3+ Years)
MIG Welder (1 Year)

Laboratory

Tensile/Compression Testing (3+ Years)
XRD (2+ Years)
Impact Testing (1+ Year)
Microindentation (1+ Year)

SEM (2+ Years)
Optical Microscopy (2+ Years)

Experiment Design (3+ Years)