

Zachary Swain  
[zswain@udel.edu](mailto:zswain@udel.edu)  
<https://udel.edu/~zswain>

## EDUCATION

### University of Delaware, Newark DE

- PhD Materials Science and Engineering
- Bachelor of Mechanical Engineering  
Aerospace Engineering Concentration, Mathematics Minor

June 2019 - Dec. 2024

Sept. 2015 - June 2019

## EXPERIENCE

### Graduate Researcher

June 2019 - Dec. 2024

University of Delaware, Materials Science and Engineering, Newark DE

- “Mechanics of Material Interfaces for Translational Engineering Design”
- Inventor of 3 intellectual properties now under patenting process by UD
- Selected for inaugural Innovation Delaware Fellows with financial award from US SBA & UD Eng.
- Responsible for \$5 million grant efforts to efficiently accelerate innovation in technology development to translate laboratory research into consumer-ready products in emerging and underserved markets
- Lead researcher of NIH clinical trial for materials conducted with human participants at NFB Baltimore
- Surface chemistry modification, adhesion & friction dynamics, wear & fouling of surfaces, interface welding, advanced additive manufacturing systems, nonisothermal heat transfer, rheological modeling
- Developed novel advanced extrusion systems for 3D printing of new materials with composite mesostructure, and novel surface chemistry friction modification for information and communication
- Funding from Chemours, Army Research Lab, Center for Plastics Innovation DOE EFRC, NIH R01

### Undergraduate Researcher

Nov. 2015 - June 2019

University of Delaware, Materials Science and Engineering, Newark DE

- Additive manufacturing, rheology & flow modeling, polymer processing, mechanical & thermal design
- Investigated flow-induced molecular orientation, thermorheological computational fluid dynamics
- Developed model for generalized extruder performance, dynamically structured filter membranes
- Funding from Army Research Lab, National Science Foundation, National Institute of Standards & Tech.

## SKILLS

- Demonstrated ability in technology innovation & translation, commercialization strategy, development / prototyping / production, lean deployment, orienting strategic objectives, team building & management
- Proficient in report & proposal writing, programming (Python, Matlab, Fortran), CAD (slicers, Inventor, Solidworks), simulation (FEA, CFD, FVM), machine design, image analysis, class 100 cleanroom trained

### Materials Characterization

- Mechanical testing
- Thermogravimetric analysis (TGA)
- Differential scanning calorimetry (DSC)
- Capillary & rotational rheology
- Dynamic mechanical analysis (DMA)
- Scanning electron microscopy (SEM)
- Spectroscopic ellipsometry
- Atomic force microscopy (AFM)
- Energy dispersive X-ray spec. (EDX)
- X-ray reflectometry (XRR)
- X-ray photoelectron spec. (XPS)
- Fourier-transform infrared spec. (FTIR)

## PUBLICATIONS

- Swain et al. "Self-assembled thin films as alternative surface textures..." [RSC Materials Chemistry B](#) Sept. 2024
- Nguyen et al. "One pot photomediated ... conductive hydrogels" [ACS Polymers Au](#) Oct. 2023
- "Positive displacement pump material delivery system..." [U.S. Patent App. 18/131,669](#) Aug. 2023
- Naqi et al. "Dual material fused filament fabrication..." [ACS Applied Polymer Materials](#) Feb. 2023
- Phan et al. "Computational fluid dynamics simulation..." [Additive Manufacturing](#) May 2020
- Edwards et al. "Maximal 3D printing extrusion rates" [IMA Journal of Applied Mathematics](#) Oct. 2019
- Phan et al. "Rheological and heat transfer effects..." [Journal of Rheology](#) Sept. 2018
- Mackay et al. "The performance of the hot end in a plasticating..." [Journal of Rheology](#) Mar. 2017

## CONFERENCE PRESENTATION

- Extrudate instabilities in fused filament fabrication... [Society of Rheology 92<sup>nd</sup> Annual Meeting](#) Oct. 2021

## ACTIVITIES

- College Leadership & Policy - University of Delaware Jan. 2023 - Present
  - NSF Innovation Corps - National Science Foundation, Northeast Region June 2021 - Present
  - SAMPE - Society for the Advancement of Material and Process Engineering Sept. 2016 - Present
  - Intramural Basketball - University of Delaware Sept. 2015 - Present
- [Coursework](#) [Research Updates](#) [Google Scholar](#) [Linkedin](#)