Zachary Swain

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**EDUCATION**

**University of Delaware**,Newark DE

• PhD Materials Science and Engineering *June 2019 - Dec. 2024*

• Bachelor of Mechanical Engineering *Sept. 2015 - June 2019*

• Aerospace Engineering Concentration, Mathematics Minor

**EXPERIENCE**

**Graduate Researcher** *June 2019 - Dec. 2024*

*University of Delaware, Materials Science and Engineering, Newark DE*

• Inventor of 3 intellectual properties now under patenting process by UD

• Selected as inaugural Innovation Delaware Fellow with financial award from US SBA & UD Eng.

• Responsible for $5M grant efforts to efficiently accelerate innovation in technology development to translate laboratory research to consumer-ready products in emerging and underserved markets

• Lead researcher of NIH clinical trial for materials conducted with human participants at NFB Baltimore

• Investigated surface chemistry modification for interfacial mechanics, adhesion & friction dynamics for human factors, surface wear & fouling mechanisms for durability, advanced additive manufacturing systems for high performance, nonisothermal heat transfer & rheological modeling for property prediction

• Developed novel advanced extrusion systems for 3D printing of new composite materials with localized properties, novel surface chemistry friction modification for non-visual information and communication

• Funding from Army Research Lab, Center for Plastics Innovation DOE EFRC, Chemours, NIH R01

**Undergraduate Researcher** *Nov. 2015 - June 2019*

*University of Delaware, Materials Science and Engineering, Newark DE*

• Additive manufacturing, flow modeling, polymer processing, mechanical & thermal design

• Investigated flow-induced molecular orientation and computational fluid dynamics for part strength

• Developed math models for generalized extruder performance and thermorheological melt process

• 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, “Mechanics of material interfaces for translational engineering design” [In Preparation](https://library.udel.edu/databases/dtud) *Dec. 2024*

• Swain et al. "Self-assembled thin films as alternative surface textures...” [*RSC Materials Chemistry B*](https://doi.org/10.1039/D4TB01646G) *Sept. 2024*

• Nguyen et al. "One pot photomediated ... conductive hydrogels” [*ACS Polymers Au*](https://doi.org/10.1021/acspolymersau.3c00031) *Oct. 2023*

• "*Positive displacement pump material delivery system*..." [U.S. Patent App. 18/131,669](https://patentcenter.uspto.gov/applications/18131669) *Aug. 2023*

• Naqi et al. "Dual material fused filament fabrication...” [*ACS Applied Polymer Materials*](https://doi.org/10.1021/acsapm.2c02152) *Feb. 2023*

• Phan et al. "Computational fluid dynamics simulation...” [*Additive Manufacturing*](https://doi.org/10.1016/j.addma.2020.101161) *May 2020*

• Edwards et al. "Maximal 3D printing extrusion rates" [*IMA Journal of Applied Mathematics*](https://doi.org/10.1093/imamat/hxz024) *Oct. 2019*

• Phan et al. “Rheological and heat transfer effects...” [*Journal of Rheology*](https://doi.org/10.1122/1.5022982) *Sept. 2018*

• Mackay et al. “The performance of the hot end in a plasticating...” [*Journal of Rheology*](https://doi.org/10.1122/1.4973852) *Mar. 2017*

**CONFERENCE PRESENTATION**

• *Extrudate instabilities in fused filament fabrication*... [Society of Rheology 92nd Annual Meeting](https://www.rheology.org/sor21a/ViewPaper?ID=344) *Oct. 2021*

**ACTIVITIES**

• College of Engineering 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](https://udel.edu/~zswain/coursework.html) [Research Updates](https://udel.edu/~zswain/#research) [Google Scholar](https://scholar.google.com/citations?user=wbKNR3gAAAAJ) [Linkedin](https://www.linkedin.com/in/zachary-swain)