

Zachary Swain  
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## EDUCATION

**University of Delaware**, Newark DE

- PhD, Materials Science and Engineering
- Bachelor of Mechanical Engineering

*June 2019 - Dec. 2024*

*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 manufacturing intellectual properties now under patenting process in US and EU
- Selected as inaugural Innovation Delaware Fellow with financial award from US SBA
- Lead researcher of NIH clinical trial for materials conducted with human subjects
- Led efforts for \$5M grant to accelerate innovation in technology development for translational research
- Investigated hybrid & advanced manufacturing systems for high performance, surface chemistry for interface mechanics, in-line composite additive manufacturing for localized material properties, material design for human factors, nonisothermal heat transfer & rheological modeling for property prediction
- Developed novel advanced extrusion systems for 3D printing of new composite materials with tunable properties, novel surface chemistry modification for non-visual information and communication
- Funding from US Army Research Lab, NSF, NIST, DOE CPI EFRC, NIH R01, NIH R21

**Founder**

*May 2023 - Nov. 2024*

*Falcon Additive, Wilmington DE*

- Advanced manufacturing systems for advanced composites, exotic materials, and gradient structures
- Managed team, company operation, licensing, product development, prototyping, and manufacturing
- Demonstrated ability in technology innovation & translation, commercialization strategy, lean deployment, team building & management, orienting strategic objectives, managing industry partnerships

## SKILLS

- 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, "Engineering mechanics of static and dynamic material interfaces..." [In Preparation](#) *Dec. 2024*
- 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

- 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*

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