Zachary Swain

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<https://udel.edu/~zswain/updates.html>

**EDUCATION**

**University of Delaware**,Newark DE

• Materials Science and Engineering PhD *June 2019 - Present*

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

Aerospace Engineering Concentration, Mathematics Minor

**EXPERIENCE**

**Graduate Researcher -** Flow Phenomena, Additive Mfg, Material Mechanisms *June 2019 - Present*

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

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

• Selected to join inaugural Innovation Delaware Fellows with scholarship award from United States Small Business Administration and University of Delaware College of Engineering

• Responsible for leading efforts for $5 million grant to efficiently accelerate innovation in technology development in order to translate laboratory research to consumer-ready products in underserved markets

• Investigating nonisothermal heat transfer in viscous flow, nozzle exit & upstream flow instabilities, flow boundary slip, expanding flow pressure oscillation, friction & adhesion mesomechanics, wear & fouling at interfaces, advanced & hybrid manufacturing systems, in-line composite additive manufacturing

• Developed novel additive manufacturing systems, axially composite desktop-scale 3D printer, model for exit instabilities in viscous nozzle flow, frictionally tunable surface chemistries for human factors

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

**Undergraduate Researcher -** Flow Modeling and Additive Manufacturing *Nov. 2015 - June 2019*

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

• Investigated rheology mechanisms, nonisobaric computational fluid dynamics in Fluent, nozzle power-pressure profile, flow-induced molecular orientation, additive manufacturing of exotic materials

• Developed mathematical model for generalized nozzle flow performance, dynamically structured filter membranes, several desktop 3D printing extrusion systems, real-time g-code modification feedback

• Funding from Army Research Lab, National Science Foundation, National Institute of Standards & Tech.

**SKILLS**

• Experienced in report and proposal writing, programming (Python, Matlab, Fortran), CAD (Solidworks, Inventor, slicers), simulation (FEA, CFD, FVM), exothermic formation enthalpy, image analysis, non-destructive evaluation, engineering drawings, mechanical & systems design, Class 100 cleanroom trained

• Demonstrated ability at process improvement, orienting strategic objectives, and team management

*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**

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

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

• Naqi et al. "Dual material fused filament fabrication via core–shell...” [(10.1021/acsapm.2c02152)](https://doi.org/10.1021/acsapm.2c02152) *Feb. 2023*

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

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

• Phan et al. “Rheological and heat transfer effects in fused filament fabrication” [(10.1122/1.5022982)](https://doi.org/10.1122/1.5022982) *Sept. 2018*

• Mackay et al. “The performance of the hot end in a plasticating 3D printer” [(10.1122/1.4973852)](https://doi.org/10.1122/1.4973852) *Mar. 2017*

**CONFERENCE PRESENTATION**

• *Extrudate instabilities in fused filament fabrication*... Society of Rheology 92nd Annual Meeting *Oct. 2021*

**ACTIVITIES**

• NATAS Member - North American Thermal Analysis Society *Mar. 2023 - Present*

• AIAA Member - American Institute of Aeronautics and Astronautics *Jan. 2023 - Present*

• SAMPE Member - Society for the Advancement of Material and Process Engineering *Sept. 2016 - Present*

• Intramural Basketball - University of Delaware *Feb. 2016 - 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)