Zachary Swain
zswain@udel.edu
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) *Dec. 2023*
• "Positive displacement pump material delivery system for additive..." (U.S. Patent App. 18/131,669) *Aug. 2023*
• Naqi et al. "Dual material fused filament fabrication via core–shell..." (10.1021/acsapm.2c02152) *Feb. 2023*
• Phan et al. "Computational fluid dynamics simulation in fused..." (10.1016/j.addma.2020.101161) *May 2020*
• Edwards et al. "Maximal 3D printing extrusion rates" (10.1093/imamat/hxz024) *Oct. 2019*
• Phan et al. "Rheological and heat transfer effects in fused filament fabrication" (10.1122/1.5022982) *Sept. 2018*
• Mackay et al. "The performance of the hot end in a plasticating 3D printer" (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*

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