Zachary Swain
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EDUCATION

University of Delaware, Newark DE
• Materials Science and Engineering PhD — *June 2019 - Nov. 2024*
• Bachelor of Mechanical Engineering — *Sept. 2015 - June 2019*
Aerospace Engineering Concentration, Mathematics Minor

EXPERIENCE

Graduate Researcher - Advanced Manufacturing & Materials Processing — *June 2019 - Nov. 2024*
University of Delaware, Materials Science and Engineering, Newark DE
• Inventor of 3 intellectual properties now under patenting process by UD
• Selected to join inaugural Innovation Delaware Fellows with financial award from US SBA & UD CoE
• Responsible for $5 million grant efforts to efficiently accelerate innovation in technology development in order to translate laboratory research to consumer-ready products in underserved and emerging markets
• Investigated advanced manufacturing systems, in-line thermoplastic composite extrusion, FFF of exotic polymers, advanced electromagnetic materials, rheological instability phenomena, crystallization kinetics, fluoro additives, nonisothermal heat transfer, interfacial adhesion and friction dynamics for human factors
• Developed novel additive manufacturing extrusion systems for compact pellet and coaxial composite extrusion in desktop FFF, on-site manufacturable custom functional orthoses, novel surface chemistries for information and communication, modelling methods for interface kinetics and mechanical dynamics
• Winner of 2024 Materials Science and Engineering *Art in Materials* contest with financial award
• Funding from Army Research Lab, Center for Plastics Innovation DOE EFRC, NIH R01, NIH R21

Undergraduate Researcher - Materials Modeling & Processing — *Nov. 2015 - June 2019*
University of Delaware, Materials Science and Engineering, Newark DE
• Managed undergraduate team, process line restructuring, equipment design & capital expenditure
• Investigated flow-induced molecular orientation and filler migration in FFF, pressure-drop extrusion phenomena, polymer melt computational fluid dynamics, interfacial welding fracture toughness
• Developed modeling method for generalizable extruder performance, dynamically structured filter membranes, low temp solder FFF, custom pick & place hybrid systems, g-code modification & feedback
• 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 coatings as alternative surface textures..." Under Review - RSC JMCB *July 2024*
• 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

• NSF Innovation Corps - Northeast Region — *June 2021 - Present*
• Society of Rheology - American Institute of Physics — *Jan. 2017 - Present*
• SAMPE - Society for the Advancement of Material and Process Engineering — *Sept. 2016 - Present*