

Zachary Swain

zswain@udel.edu

www.zswain.com



EDUCATION

University of Delaware, Newark DE

- PhD, Materials Science and Engineering
- Bachelor of Mechanical Engineering
- Aerospace Engineering Concentration, Mathematics Minor

June 2019 - Dec. 2024

Sept. 2015 - June 2019

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 by UD
- Selected as inaugural Innovation Delaware Fellow with financial award from US SBA
- Responsible over efforts for \$5M grant 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 modification for non-visual information and communication

Undergraduate Researcher

Nov. 2015 - June 2019

University of Delaware, Materials Science and Engineering, Newark DE

- Managed undergraduate team, process line restructuring, equipment design & prototyping
- Additive manufacturing, flow modeling, polymer processing, mechanical & thermal design
- Investigated induced molecular orientation for part strength, computational fluid dynamics modeling
- Developed math models for generalized extruder performance and thermorheological melt process

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 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 3D printer" [Journal of Rheology](#) *Mar. 2017*

CONFERENCE PRESENTATION

- *Extrudate instabilities in fused filament fabrication...* [Society of Rheology 92nd 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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