Dr. Kaiwen Hsiao Open Seminar Talk Title and Abstract

From single polymer dynamics to high-resolution additive manufacturing

Molecular structure and hierarchical assembly dictate the function of soft materials in both natural and engineered environments. Development of advanced functional materials lies in integrating three-dimensional patterning, polymer processing, and design of molecular structure and dynamics across time and length scales. Recent progress in advanced additive manufacturing (AM) that integrate high-resolution 3D printing with scalable processing has accelerated the transition from current manufacturing methods to new paradigms for developing tunable, responsive, and functionally graded materials with relevance from optoelectronic waveguides, separation membranes and flexible electronics.

In the first part of my talk, I will present the advance of Continuous Liquid Interface Production (CLIP) 3D printer towards single-digit micron resolution with print speed 10^5 faster than existing high-resolution AM technologies. Building upon the co-design of projection optics, photopolymerization kinetics modeling, non-Newtonian fluid dynamics modeling, and software system integration, the high-resolution CLIP 3D printer has overcome the major technological challenges in scalability and print resolution, bringing high-speed manufacturing down to the length scale that is relevant for design of biomedical applications.

In the second part of my talk, I will discuss the interplay between polymer intermolecular interactions and non-equilibrium dynamics that govern the critical time and length scales in material processing and structural patterning. A combined approach using precision microfluidics, micro-rheology, and single-molecule fluorescence microscopy was developed to reveal polymer transient dynamics and the microscopic origin of material stress development under flow.

Dr. Kaiwen Hsiao Short Bio

Kaiwen Hsiao is an incoming assistant professor at Texas A&M University Department of Materials Science and Engineering. She recently completed her postdoctoral research at Stanford University, DeSimone Lab. Her postdoctoral research focuses on developing high-resolution 3D CLIP printers and developing stereolithography computational models. Her research interests involve in fabricating micro-architectures for bio-oriented applications and microelectronic applications. Before she joined Stanford, she worked on computational lithography as a design engineer at Intel and at Apple camera hardware. She did her PhD at University of Illinois at Urbana Champaign in Schroeder lab where she focused on understanding the intermolecular interactions of concentrated polymer solutions and ring polymers.